EMISSION TRADING

A Canadian Policy Framework

Emission Trading Working Group
Canadian Council of Ministers of the Environment

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PREFACE

This document is a comprehensive examination of atmospheric emission trading. It is intended to serve as a resource document to assist individuals and institutions to understand the concept of emission trading and assess its potential application as a public policy tool to control harmful air emissions. The report represents the input, scrutiny, and support of an interdisciplinary group of economists, engineers, and public policy specialists from various jurisdictions. The numerous issues, conclusions, and recommendations outlined in the report are the product of many hours of analysis and debate and reflect the strong commitment of those involved.

Although the assessment developed in this report has been an important step in reviewing the potential utility of emission trading, it is only the beginning. The challenge ahead is to begin the process of multi-stakeholder consultations in the context of design and possible implementation of a pilot emission trading program and to encourage both public and private institutions across Canada to consider emission trading applications.

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CONTENTS

Executive Summary viii

Introduction 1

Purpose 1
Scope and method 1
Emission trading: concept and potential 1
American experience with emission trading 2
Issues 2
Emission trading in the Lower Fraser Valley 3
Conclusions and recommendations 3

1. Controlling Air Emissions 4

Air management goals 4
Instruments available to government 7

2. The Concept Of Emission Trading 11

The basic idea of emission trading 11
A different regulatory approach 11
Levels of emission trading 13
Emission trading: the basic model 13
Features to extend or restrict 14
Why consider emission trading? 15
The potential role of emission trading 16
Common objections to emission trading 17

3. Emission Trading Experience To Date 21

Experience in Canada and the United States 21
National programs: allowances 21
Case studies of local programs: reduction credits 23

4. Policy And Design Issues 25

Is emission trading an effective method of air management? 25
Program design: program goals and pollutant characteristics 26
Scope of market: sources 27
Scope of market: pollutants 30
Scope of market: levels of trading 32
Initial allocation of emission allowances 33
Structuring the initial allocation 35
Fairness between sources inside the program and sources outside . 39
Regional imbalances 40
Banking of surplus emission allowances 41
Maintaining a competitive market 44
Shutdown credits 46

5. Administrative Issues 48

Legislative authority 48
Monitoring and enforcement 49
Between jurisdictions: enforcement and equivalences 51
Between jurisdictions: uniformity of practice 53
New administrative requirements 54
Administrative costs: emission trading vs command-and-control . . 56
Taxation of emission allowances 57

6. Emission Trading In The Lower Fraser Valley: Preliminary Assessment 58

Scope 58
Emission quantities and sources 58
Ozone episodes 59
Program options and features 59
Seasonal and episodic considerations 61
Economic benefits 61
Market competition 62
Conclusions and recommendations 62

7. Future CCME Involvement **64**

8. List Of Recommendations And Conclusions **66**

Recommendations 66
Conclusions 67

EXECUTIVE SUMMARY

Atmospheric Emission Trading: What Is It?

Emission trading is a market-based incentive program designed to control air emissions. An emission trading program would work as follows:

- A cap is placed on the total quantity of pollutants allowed to be emitted within an airshed.
- An appropriate share of the total amount of pollutants allowable is allocated to each participating emission source within the airshed.
- Participating firms can then buy or sell their emission shares.
- Firms with low pollution abatement costs would increase their pollution abatement activities and sell their surplus emission shares to firms with high pollution abatement costs.

Two key advantages of an emission trading program are:

- its potential to achieve air emission targets at a lower total cost to society than under a "command-and-control" approach.
- its ability to accommodate economic growth without compromising environmental quality.

Assignment Of The Emission Trading Working Group

The Atmospheric Issues Task Group, under CCME, identified the need to evaluate the potential use of emission trading programs to achieve emission reduction goals set for

- the ozone precursors NO_x (nitrogen oxides) and VOCs (volatile organic compounds) by Canada and by the Greater Vancouver Regional District for the Lower Fraser Valley.
- SO_x (sulphur oxides) by the Canada/U.S. Air Quality Accord for Canada.

The Emission Trading Working Group included representatives of the SO_x Emission Trading Working Group in undertaking this study.

The assignment had three main objectives:

- to conduct a detailed review and evaluation of the U.S. federal and state atmospheric trading programs, outlining the reasons for the success or failure of these programs
- to conduct a preliminary assessment of whether or not an emission trading program for NO_x and VOCs could be implemented in the Lower Fraser Valley
- to identify and review the numerous policy issues associated with the implementation of emission trading programs.

This document reports the results of that assignment.

Contents Of The Report

The report comprises an introduction and eight chapters, whose contents can be summarized as follows:

1. Controlling air emissions

Governments establish air management goals for air quality and for emission reduction. To achieve these goals, governments employ a variety of policy instruments: regulation, spending, institutional structures, and market-based incentives. Most widely used is "command-and-control" regulation, where government imposes emission standards on individual sources. Emission trading is an alternative which uses market-based incentives to achieve the same goals.

2. The concept of emission trading

Emission trading is a basic concept which in practice can take many forms. Trading can occur within sites, between sites within firms, between firms, between jurisdictions, and between airsheds. Trading rule options can extend or restrict trading activity. Emission trading can reduce pollution control costs, improve compliance with air management goals, develop a better public-private split of responsibilities, and has proven effective in many cases. Emission trading will be more effective the wider the range of allowable trades, more useful in regions with serious air quality problems, and especially important in areas where air management priorities may place economic growth at risk.

3. Emission trading experience to date

Apart from internal trading of emissions among Ontario Hydro's six fossil-fuel generating plants, virtually all other North American experience with emission trading has occurred in the United States. Three U.S. federal programs are reviewed: lead in gasoline (completed), CFCs (current), and sulphur dioxide (proposed). In addition there are about 30 local U.S. emission trading programs, of which five are reviewed. Savings in abatement costs up to 1989, compared to abatement costs with an equivalent command-and-control approach, are estimated at $10-13 billion. A set of twelve factors important for the success of emission trading are identified, including clearly defined goals, accurate emission inventories, and clear and comprehensive compliance requirements.

4. Policy and design issues

Because of the flexibility of emission trading, policy issues (feasibility, merits, weaknesses) are closely linked with design issues (possible adaptations and their implications). Key issues involving both areas are identified, including among others the determination of the scope of the market in terms of pollutant types, source types, and levels of trading; options for making the initial allocation of emission allowances; addressing imbalances between trading regions or between sources inside and outside the program; banking of surplus allowances; and maintaining a competitive market. Each issue is explained and discussed, and the Working Group's conclusions are given. Overall, the Working Group endorses the potential value of emission trading as an air management option.

5. Administrative issues

The introduction of emission trading raises a number of administrative questions for government policy-makers. Prominent among these issues are the matter of legislative authority for a program, monitoring and enforcement requirements, possible problems that may arise if trading occurs between jurisdictions, and whether new administrative resources may be needed. As before, the issues are explained and analysed, and conclusions are indicated.

6. Emission trading in the Lower Fraser Valley: preliminary assessment

The Working Group assessed the ability of emission trading to help control ozone pollution in the Lower Fraser Valley. Possible adaptations of the emission trading principle were considered in light of data on emission quantities and

sources, atmospheric conditions, pollutant characteristics, etc. The main advantage offered by emission trading would be to allow continued economic growth within a context of drastic reductions in allowed emissions of NO_x and VOCs. Other benefits include the avoidance of overcontrol, the adoption of a wider range of control options, and overall savings in abatement costs. The Working Group thus endorsed emission trading as a potentially valuable option for controlling ozone in the Lower Fraser Valley.

7. Future CCME involvement

Its task concluded, the Working Group considered what should happen next. It proposed several encouraging and supporting activities appropriate for CCME to undertake. These are the subject of recommendations.

8. List of recommendations and conclusions

The final chapter compiles and lists for easy reference all the conclusions and recommendations reached by the Working Group in this study.

Recommendations

The report makes the following recommendations:

- CCME should endorse the concept of emission trading as a potentially valuable instrument of public policy for air management.
- An emission trading program for the control of NO_x and VOCs in the Lower Fraser Valley is feasible. Specific issues of its potential application should be determined by stakeholder consultation on program design.
- BC Environment should propose explicit legislative authority to implement and fund an emission trading program in the Lower Fraser Valley.
- Environment Canada, BC Environment, the Greater Vancouver Regional District, and other regional authorities should form a partnership to:
  - design,
  - implement, and
  - evaluate an emission trading program.

- CCME should encourage and support the formation of provincially led regional groups (ie in the Windsor/Quebec Corridor and in the St John, New Brunswick, area) to evaluate the potential for emission trading to address NO_x and VOCs control in their areas.
- The CCME task force studying the use of emission trading for SO_2 should review the findings of U.S. experience and the policy implications in assessing the benefit of an SO_2 trading program in Canada.
- CCME should sponsor early information sessions on emission trading intended to increase understanding among the public and stakeholders and promote the development of regional emission trading initiatives.
- CCME should monitor and assess regional emission trading programs and should also evaluate the feasibility of emission trading programs for other atmospheric contaminants and other geographic areas.

INTRODUCTION

Purpose

With this report, the members of the Emission Trading Working Group present the results of their inquiry into the concept and feasibility of emission trading as an air management policy instrument for Canadian jurisdictions generally and for those in the Lower Fraser Valley in particular. The report will be used in the development of policy by the Atmospheric Issues Task Group under the Canadian Council of Ministers of the Environment (CCME) and also in the evaluation of emission control options by the air management authorities of the Greater Vancouver Regional District (GVRD).

Scope And Method

The members of the Working Group commissioned a review of U.S. experience with emission trading, combined with a study of the feasibility of a particular Canadian project: an emission reduction program incorporating emission trading of the ozone precursors nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the Lower Fraser Valley. The results of that study (presented in the companion report by Barakat & Chamberlin) helped the Working Group identify and analyse the important issues influencing the design and implementation of emission trading. The Working Group's findings, conclusions, and recommendations on the issues are presented in this report.

Emission Trading: Concept And Potential

Emission trading is a way of implementing emission controls that contrasts with conventional regulatory methods. Conventionally the government determines and imposes emission limits on every significant individual source or class of sources, an approach often called "command-and-control". Under emission trading, on the other hand, the government would distribute "emission allowances" to all sources authorizing their emission quantities. A source reducing its emissions would thus have surplus allowances, which it can sell to another source wishing to emit more

than the amount covered by its allowances. All sources must periodically demonstrate that they possess enough allowances to cover their emissions. Regulators control total emissions by controlling the quantity of allowances: reducing the allowances cuts total emissions.

The advantage of emission trading is that regulators are not required to determine and impose control technologies and emission standards for every individual source. Government basically sets and enforces the overall target and lets market interactions among the sources determine the distribution of emission reductions according to who can make them least expensively. The emission trading approach brings to the private sector the advantages of freedom, flexibility, and lower control costs. For government the administrative effort can be reduced and the costs more easily recovered compared to a command-and-control system of equivalent impact on air quality. An additional benefit to society is accelerated compliance with emission control objectives.

American Experience With Emission Trading

Emission trading has scarcely been used in air management in Canada, but it has been used in the United States since 1976. The best known instance was the U.S. program to accelerate the phaseout of lead from gasoline. Another U.S. program pertains to CFCs, and a third is planned to help cut sulphur dioxide emissions to meet acid rain objectives. Also helping to deal with air pollution in the United States but at a regional scale are about 30 local emission trading programs, several of them in California. These local programs use a restricted form of emission trading based on "emission reduction credits", which act as a supplement to command-and-control to maintain air quality while allowing economic growth. As experience with these reduction credit programs has grown, the trend has been to remove the cumbersome trading rules and approval procedures which have at times severely limited trading activity.

Issues

With emission trading the basic question is often not whether it can be applied at all in a particular situation but rather what trading rules would be needed for that situation and whether these rules would render emission trading ineffective. The central issue is one of implementation: as trading restrictions and approval

procedures proliferate, trading activity becomes too difficult and costly and thus withers away. In designing a potential program there is an ongoing compromise between controlling trading and encouraging it. The report identifies and explores the key areas of design choice and compromise.

Another set of issues concerns the changes required of government regulatory authorities to introduce emission trading programs. The report considers in some detail the extent to which emission trading would place new organizational demands on a regulatory structure oriented to and developing towards command-and-control regulation.

Emission Trading In The Lower Fraser Valley

The Vancouver area is afflicted with summertime episodes of smog and ozone when atmospheric conditions interact with emissions of NO_x and VOCs. The GVRD is developing an aggressive program to cut these emissions in half and is considering the potential use of emission trading to assist in emission reductions. The analysis by Barakat & Chamberlin concludes that emission trading, either full allowance trading or more restricted emission reduction credits, could help reduce ozone in the Lower Fraser Valley.

Conclusions And Recommendations

The conclusions reached and recommendations made throughout the study are listed in the final chapter.

The Working Group, in light of its mandate, makes three main sets of recommendations: endorsing emission trading as an air management option, proposing that further steps be taken towards implementing emission trading in NO_x and VOCs in the Lower Fraser Valley, and suggesting a future role for CCME in supporting emission trading initiatives in Canada.

Furthermore, in its analysis of the issues, the Working Group has reached some specific conclusions and suggestions which will be useful for organizations evaluating the potential of emission trading for different pollutants or different trading locations.

1. CONTROLLING AIR EMISSIONS

Air Management Goals

Air management goals in Canadian jurisdictions fall into two broad classes: "air quality" and "emission reduction". These two types of goals approach the problem of air pollution from different directions. Air quality objectives consider the recipients. Usually expressed as numerical concentrations (eg parts per billion), these objectives are based on studies that extrapolate to human beings or the environment the measurable effects of contaminant exposures on the health and growth of selected animals and plants. In contrast, emission reductions consider the emitting sources. Often expressed as percentage reductions below the emission levels of a given year, they are based on information about the technical and economic possibilities of avoiding or controlling the release of pollutants into the air by industry and individuals.

Air quality objectives

Federal and provincial governments and some municipalities in Canada have established air quality criteria for selected airborne pollutants. For example, Table 1 shows a selection of federal criteria affecting the pollutants of central concern in the present study: ozone, nitrogen dioxide, and sulphur dioxide.

For nitrogen dioxide and for ozone, some provinces have established their own air quality criteria. In most cases these provincial criteria are the same as the national ones, though less detailed, and the few deviations from national criteria are minor (CCME, Management Plan for NO_x and VOCs, B-3).

Emission reduction objectives

Various Canadian jurisdictions have established emission reduction goals for the ozone precursors (NO_x and VOCs) and for sulphur dioxide (Table 2). Many of these goals represent international commitments. Emission reduction objectives are developed to guide progress towards attaining air quality objectives.

TABLE 1: Examples of Canadian air quality objectives

Maximum averages (ug/m^3)	1-hour
Ozone	
Desirable	100
Acceptable	160
Tolerable	300
Nitrogen dioxide	
Desirable	
Acceptable	400
Tolerable	1000
Sulphur dioxide	
Desirable	450
Acceptable	900
Tolerable	

SOURCE: Management Plan, Appendix B

TABLE 2: Emission reduction goals (selected contaminants)

Authority	NO_x	VOCs	SO_2
International commitments	NO_x emissions stabilized at 1987 levels by 1994 (ECE NO_x Protocol), reduction of 100 kt by 2000 (US/Canada Agreement)	National freeze on VOC emissions at 1988 levels and 30% reduction by 1999 within Ozone Management Areas (discussions on ECE VOC protocol)	Total Canadian SO_2 emissions to be stabilized at 3.2 million tonnes/year by the year 2000 (1991 US/Canada Agreement, CCME Acid Deposition Cap)
Federal/provincial agreements			Emissions cap of 2.3 million tonnes/year by 1994 as well as provincial limits (federal government and provinces east of Saskatchewan)
Management Plan	Interim reduction targets (Phase 1) and emission caps (Phase 2) to be established for 1995 - 2005 (Management Plan, xiii-xiv)		
Greater Vancouver Regional District	Cut total emissions by half by the year 2000	Cut total emissions by half by the year 2000	Cut total emissions by half by the year 2000

Instruments Available To Government

The methods available to government to achieve its environmental and resource management goals can be grouped in four categories:

- Regulation: imposing standards by statute
- Spending: on environmental programs, research, and capital infrastructure
- Institutional structures: special organizations (eg Round Tables) and practices (eg environmental assessments) to promote consultation and dispute resolution
- Market-based incentives: fees, levies, tax incentives and other ways of using prices and market forces to change industrial and consumer behaviour.

Table 3 gives examples of government activity across Canada in air management in each of these categories.

In Canadian jurisdictions, air management has primarily used regulation. By contrast, emission trading, the subject of this report, represents a market-based approach. The report therefore focuses on the differences between these two approaches and on their relative merits and potentially complementary roles as policy instruments in air management.

Regulation: "command-and-control"

Statutory intervention in air management in Canada occurs in a variety of ways. Table 4 gives a selection of representative examples of regulation from the jurisdictions of members of the Emission Trading Working Group. Similar examples could be drawn from other provinces as well.

An important feature of most of this regulation is that emission limits, and in some cases emission control technology requirements, are spelled out for each emission source in the licences and permits needed to operate, construct, or alter facilities and equipment. The regulating authority imposes and enforces these limits and requirements within a range of discretion that is often small or nil. The controls become more stringent if air quality continues to deteriorate and as better control technologies become available. At the limit, in regions where air pollution has made emission reduction crucial, licences and permits for new facilities or expansions may be withheld.

The principle that government directs private entities to engage in or refrain from specified actions or behaviour is referred to as the "command-and-control" approach.

TABLE 3: TYPES OF GOVERNMENT AIR MANAGEMENT ACTIVITY IN CANADA, WITH SELECTED EXAMPLES

Regulation

- Atmospheric goals and objectives
- Emission permit systems
- Emission guidelines
- Pollutant-specific and source-specific regulations
- New Source Performance Standards

Spending

- Contaminant research: health and environmental effects
- Emission control technology assessment
- Hazardous waste management facilities

Institutional structures

- Round Tables on Environment and Economy
- CCME Working Groups
- Pollutant management plans and strategies
- Recycling systems to reduce incineration

Market-based incentives

- Environmental levies on products
- Emission trading
- Permit fees for discharges

TABLE 4: Examples Of Regulation In Canada

- Canada:
  - Canadian Environmental Protection Act: federal regulation of sources of toxic contaminants eg asbestos, mercury, vinyl chloride, PCBs
  - Motor Vehicle Safety Act: required pollution control equipment and exhaust emission limits.
- Alberta:
  - Clean Air Act and Regulations: requirements for construction permits, operating licences, and permits for expansion and alterations
  - Natural Gas Compressors: legislation defines types, exhaust stack dimensions, liquid waste control, noise levels
  - Natural Gas Processing: criteria for stack exit temperatures, design criteria for sulphur recovery
  - Visible Emissions Code (and other Guidelines and Standards for many source types)
- British Columbia:
  - Pollution Control Objectives by industry groups: to guide regulators setting criteria in operating permits
  - Sulphur Content in Fuel: ceiling established
  - Motor Vehicle Inspection and Maintenance: new system being developed for Lower Mainland
  - Special Waste Emission Criteria: standards for incineration of hazardous waste
- Manitoba:
  - Environment Act: environmental assessment requirements for new developments
  - Incinerators Regulation: emission limits for incinerators
  - Inco/Hudson Bay Mining Smelter Regulations: sets annual caps for sulphur dioxide and particulates at two sites
- Ontario:
  - Regulation 308 (General -- Air Pollution) under the Environmental Protection Act: point of impingement standards and models used to relate emission rates/conditions to potential impacts
  - Environmental Assessment Act: requires detailed analysis of all potential environmental impacts of significant undertakings
  - Clean Air Program: (to replace Regulation 308) will impose direct emission limits on sources for many more contaminants
  - Acid Rain Reduction: schedule of reductions of sulphur dioxide emissions for Ontario Hydro, Falconbridge, Inco, and Algoma Steel
  - Ferrous Foundries Regulation: particulate collection efficiencies imposed.

Market-based incentives

As an alternative to command-and-control, governments can set fees, impose taxes, or create marketable commodities as economic incentives to shift the behaviour of consumers or regulated entities in directions desired by policy. A familiar example would be a high tax on tobacco to deter smoking. In relation to environmental policy generally, and air pollution control in particular, market-based incentives are of several types:

- Consumption taxes: such as a carbon tax on fossil fuels in proportion to their carbon emissions during combustion
- Effluent or emission charges: rates for discharging pollutants or waste water based on quality and quantity
- Subsidies: such as support for home insulation programs to conserve energy
- Emission trading: in which a market is instituted for quantities of emissions.

Emission trading to combat air pollution has so far been used in Canada only by Ontario Hydro (internally, among its fossil-fuel generating units) as part of its reduction program for emissions which contribute to acid rain.

2. THE CONCEPT OF EMISSION TRADING

The Basic Idea Of Emission Trading

Emission trading as a means of maintaining or improving air quality can be instructively contrasted with command-and-control regulation. Whereas command-and-control looks at every discharge source and applies a specific control technology or a stated limit to each one, emission trading places an overall limit on a group of sources and, in effect, allows them to arrange among themselves how they will meet it.

Consider five discharge sources of a contaminant:

- Under command-and-control, each source must limit its discharges to the appropriate standard, resulting in a total release for all five of, say, *x* tonnes per time interval.
- Under emission trading, compliance is satisfied provided all five sources together release no more than *x* tonnes per time interval.

Thus, under emission trading (but not under command-and-control) an emission reduction made at one source can be reassigned and attributed to another source as though it had been made there. Emission trading demands that the overall limit be met, but is generally indifferent about who does the controlling (though trading restrictions may be used to prevent clustering of emissions). This contrasts with command-and-control, which dictates individual emission levels and sometimes control technologies and then imposes an overall emission limit by refusing to issue additional operating permits.

In emission trading the reassignment of emission reductions among sources can occur within firms as well as between firms. In US experience, most "emission trading" occurs within firms.

A Different Regulatory Approach

Command-and-control is often associated with the requirement to adopt the "best available control technology economically achievable", sometimes called "BACT" or "BAT-EA". By imposing this requirement as an intermediate goal, command-and-

control works indirectly through technologies towards emission control goals. By contrast, emission trading implants the emission control goals directly and explicitly into the program as an emission cap, holding the allowance quantities constant or reducing them as the goals imply. But technological change for emission trading is a byproduct of the program, a result rather than a means. Thus both emission trading and command-and-control bring about technological innovation, and in so doing they provide two different definitions of BACT:

- With command-and-control, BACT is specified by regulators based on technical engineering and economic feasibility studies for selected industries and processes and then implemented by negotiation with industry representatives in light of their economic circumstances.
- With emission trading, BACT is not specified by regulators but is defined in practice by the decisions of the emitters themselves using a market for emission allowances to determine the most cost-effective selection and distribution of control technologies required to meet their total allowed emissions. Emitters invest in pollution control up to the point where the cost of additional emission reduction equals the cost of an additional emission allowance. The resulting distribution of investment in pollution control is the practical realization of BACT.

These two kinds of BACT differ markedly when, as almost always is the case, the cost of emission control varies between sources. Total emissions will not differ if the program goals are the same and equally enforced. But the distribution of emission controls and the types of control technologies adopted will be decided on different principles:

- Successful command-and-control results in each source approximating its pre-defined appropriate control technology and emission limit.
- Successful emission trading results in equal marginal costs of emission control among sources, with control costs minimized for each emitter and for all together, and with the distribution and selection of control technologies decided by the emitters.

This difference reveals the essential rationale for emission trading, the benefits that would make it justified and preferred in the right circumstances. These are mainly economic: the room it provides for economic growth even when total emissions are being limited or reduced, the savings in emission control costs

imposed on emitters for an equivalent control effort, and the resulting acceleration of compliance with emission control goals.

Levels Of Emission Trading

Emission trading can occur at many levels:

- Within-site: a set of monitored sources on a single site is considered as one (a "site bubble"), allowing a fixed total of emissions for the site to be reassigned between individual sources within the site.
- Within-firm: a set of sites owned by a single firm within a region is considered as one (a "firm bubble"), allowing a fixed total of emissions for the firm to be reassigned between sites within the firm.
- Between firms: a set of firms having emission sites within a region (airshed, etc) are considered as one, allowing a fixed total of emissions for the set of participating firms to be reassigned between firms and sites.
- Between jurisdictions: emissions can be reassigned between firms in two or more jurisdictions.
- Between airsheds: emissions can be reassigned between firms located in widely separated regions.

These categories can ordinarily be thought of as levels, with each usually presumed by the next higher one.

At higher levels there is often more government involvement, greater incentives, and larger potential benefits. But lower levels of trading can also be desirable even when higher-level trading is inappropriate.

Emission Trading: The Basic Model

Emission trading between firms, at its simplest, requires the following:

- Delineation of an area within which trading can occur, such as an airshed.
- Establishment of a "cap" consisting of a fixed total annual quantity of emissions of a given contaminant for participants, initially at or near the current total emissions of participants but (if emission reduction is the goal) thereafter lowered annually according to a schedule.

- Distribution or allocation of shares of this total allowable quantity to emitting firms according to some principle (eg in proportion to average recent emission rates), with these shares in the form of allowances of stated emission quantities.
- Adequate monitoring:
  - of discharges to allow calculation of each firm's total emissions
  - of emission allowance ownership and trades to ensure procedures are followed.
- Demonstration to regulators that a firm possesses enough emission allowances to cover all its emissions.

A firm whose emissions are expected to exceed the allowances in its possession can either reduce its emissions or purchase other firms' surplus emission allowances. But the latter will only be available for purchase to the extent that other firms reduce their emissions and wish to sell their surplus allowances.

In effect, the firm purchasing the allowances rather than financing its own emission reductions is paying for equivalent reductions to be made by other firms in the trading region.

Features To Extend Or Restrict

The basic emission trading model is usually implemented with additional features that modify the trading rules. Some of these modifications extend and encourage trades, while others impose restrictions on trades to adapt them to special circumstances:

- Extending options:
  - Interpollutant trades: equivalency ratios between particular pollutants (eg individual VOCs) allow reductions in emissions of one pollutant to be reassigned to other pollutants.
  - Banking: surplus allowances, rather than being traded in the present, can be held for future use or trade.
- Restricting options:
  - Supplementing command-and-control: emission trading is used on top of (rather than instead of) command-and-control regulation, which continues to be imposed on all sources. But new or expanding sources must also purchase emission allowances to cover their emissions. Economic growth ensures potential buyers of allowances and therefore gives an incentive to additional

emission reductions by existing sources. This combined approach is the basis of the typical U.S. "emission reduction credit" program.

- Ambient air quality assurance: emission trades can be subject to approval based on demonstration, using dispersion modelling techniques or conforming to pre-defined geographic trading rules, that a trade will not degrade ambient air quality at any location in the region.

Why Consider Emission Trading?

In the right circumstances, emission trading enjoys a number of advantages over command-and-control regulation:

- Reduced pollution control costs: A given total emission reduction costs less overall with emission trading than with command-and-control. Firms with lower emission control costs have an incentive to undertake more abatement than required, thereby leaving themselves with surplus emission allowances to sell. Firms with higher emission control costs can buy those allowances more cheaply than undertaking an equivalent amount of reduction themselves. The savings to industry improve general economic competitiveness.
- Improved compliance: Command-and-control regulation is sometimes hard to enforce. Faced with a requirement to purchase expensive control technology, polluters have many options besides compliance and have shown an ability to use these options frequently and effectively: administrative appeals on grounds of costs, capabilities, etc; political appeals on grounds of regional development, job loss, etc; protraction of decisions through vigorous use of judicial procedures; acceptance of nominal penalties. With emission trading, an individual polluter has the alternative of buying emission allowances. Moreover, it is easier for a polluter to claim that the purchase of a particular kind of expensive control technology is unreasonable or impossible than to make the same claim about the purchase of additional emission allowances.
- Proven effective: Emission trading is increasingly employed in areas of the United States with air quality problems, where it has been successful in promoting development that meets environmental standards. American experience has shown which factors are especially important for success in emission trading, notably accuracy of inventories and monitoring and minimizing of cumbersome trading rules.

- Better public/private split of responsibilities: Command-and-control uses what industry regards as an intrusive strategy, reviewing (and perhaps disputing) business decisions about the cost-effectiveness of particular technologies. Regulators may require process information that is difficult to obtain or confirm because a firm regards the information as confidential. By contrast, emission trading is hands-off. An emission reduction is regarded as equally valuable whoever makes it. The overall level of control or reduction desired is determined on environmental grounds, and then emission trading allows firms to find the most cost-effective ways of meeting their obligations.

The Potential Role Of Emission Trading

Emission trading is not universally applicable as a substitute or supplement for command-and-control. It is an option only where conditions are suitable, and frequently it is combined with fixed standards such as minimum air quality thresholds. In general there are three things to be said about the value of emission trading as a regulatory alternative:

- More effective the wider the universe of allowable trades: In principle, emission trading loses value to the extent that restrictions on trading are imposed. Thus, it becomes more effective:
  - the larger the geographic trading area
  - the more numerous the participating traders
  - the more levels at which trading is allowed (within sites, within firms, between firms, between jurisdictions, between airsheds)
  - the fewer additional command-and-control limits are imposed (eg New Source Performance Standards)
  - the wider the interpollutant trading
  - the easier the conditions and approval requirements for trades
  - when banking of surplus allowances is possible.
- More useful in regions with serious air quality problems: Emission trading tends to be most potentially valuable when emission restrictions and requirements are severe, such as for smog and ozone in the Lower Fraser Valley or the Windsor-Quebec Corridor. The following characteristics, frequently found where

regions have air quality problems or where sources face tight emission restrictions, enhance the value of emission trading:

- Sources in the potential trading area are numerous and diverse, generating a better market.
- Regulatory pressures on firms for emission reductions threaten shutdowns or an end to development.
- Reduction costs are high and unevenly distributed among a variety of sources.
- Pollution is more a common than a localized problem, and shifts in specific emission locations are of less importance than overall air quality.

- Vital where economic growth is at risk: Emission trading can allow continued economic growth in places and among sources where the need to limit emissions is becoming acute. New firms can purchase the emission allowances they require without jeopardizing environmental objectives, which are protected by the ceiling on total emission allowances. Moreover, the creation of a market in emission allowances brings economically valuable results not easily available under command-and-control regulation:
  - emission control is accomplished by the sources best able to do it, the sources whose own control is least costly
  - in this way the cost of emission control across all sources is minimized.

Emission trading thus does the utmost that can be done to allow an industry, an economy, a society, to reduce the cost of improving emission controls. This is particularly important in situations where the costs of reducing emissions further are so high that the ability to make the improvements is in doubt and success therefore depends on finding every possible way to minimize those costs.

Common Objections To Emission Trading

Emission trading is a comparatively new concept in Canada. Like many unfamiliar concepts it is often greeted with objections. These objections deserve to be examined in any discussion of the appropriateness of emission trading. This section considers the criticisms most often raised in light of what the Working Group has learned about emission trading.

Unregulated markets are what caused the problem in the first place

The implication is that more regulation is the answer, whereas emission trading would mean less regulation. "Regulation" is here identified with the imposition of tighter air quality and emission standards. But the stringency of standards is not at issue in the discussion. The issue is the manner in which any standards (whether strict or lax) are specified and imposed. With command-and-control, government specifies control technologies and/or emission standards for each point source. With emission trading, government establishes overall air quality and emission targets and lets market transactions decide the distribution of control technologies among individual point sources.

In a successful emission trading program, that final distribution of control technologies will be different and less costly than the different distribution that would result from command-and-control regulation which had an equivalent impact on total emissions. By minimizing the control costs for a given emission target, emission trading offers the prospect of making stringent standards more economically feasible and thus more enforceable, rather than less.

Emission allowances are licences to pollute

Under any air management system the government establishes, controls, and allocates permissions to emit pollutants. That is as true of command-and-control as of emission trading. The difference is that with command-and-control the emission allowance is permanently tied to a particular point source, whereas with emission trading the emission allowance is tradable among sources.

If "pollution" means "emitting pollutants", the objection encompasses command-and-control as well. If "pollution" means "emitting in excess of best current technology", it is true that emission trading can tolerate such behaviour from some facilities provided other facilities can perform better than "best current technology". However, if local problems of air quality could result from emission trading, restrictions can be placed on allowable trades to ensure that acceptable air quality will be maintained throughout the airshed.

Emission allowances use public resources to enrich polluters

In emission trading, emitters acquire emission allowances as private assets that can be sold for money. If the allowances are granted free rather than auctioned, emission trading could indeed create "windfall profits" by converting public resources into transferable private assets. But a similar alienation happens

ordinarily anyway. The customary practice retained in command-and-control regulation is simply to offer private emitters direct access to public resources (the assimilative capacity of the environment).

In both ways of granting private access to public resources, restrictions are imposed. Just as command-and-control requirements can make access to atmospheric sinks difficult and costly for an emitter, so the rules of emission trading can be designed to prevent emission allowances from being used in ways that do not benefit society and the environment. Potential anti-competitive practices and ways to prevent them through emission trading rules are discussed throughout this report. In addition, emission trading, by quantifying the value of these resources, opens a channel by which the public can recapture some of the value of the resources through taxation. The value of the resources can of course also be recaptured by the public through emission charges under either command-and-control or emission trading.

A new market in resources will help big firms squeeze out little ones

For the benefits of emission trading to be realized, the market in emission allowances must be active and competitive. As will be seen in this report, a central theme in the design of such programs is the establishment of measures to encourage vigorous trading activity and to prevent anti-competitive practices.

Emission trading is intended eventually to replace traditional command-and-control regulation

Command-and-control regulation will always exist. Emission trading can in some cases substitute for it and can in other cases be combined with it as a supplement. But emission trading will be applicable or most useful only for certain types of sources and pollutants.

Where sources are small and numerous, the emission monitoring required for a trading system may be much less practical than imposing technologies or standards, as with emission standards for new vehicles.

Emission trading is normally suitable for pollutants without or with very modest local impacts, because the controls required to address local impacts interfere with trading. Pollutants with severe and highly local impacts -- chemicals that are toxic, reactive, explosive, etc -- will normally receive strong command-and-control regulation, perhaps sometimes supplemented with a trading system to

accelerate compliance, as was successfully done with leaded gasoline in the United States.

For government there are advantages to using emission trading when circumstances are suitable. One advantage is the saving in administrative cost that comes from leaving the task of control technology assessment up to the private sector. Command-and-control is burdened with the administrative cost of updating site-by-site regulations to keep abreast of rapidly advancing control technology. Another advantage to government is a clearer and more defensible division of public and private responsibilities. With emission trading the government sets environmental requirements and enforces them, while private firms are free to choose the technologies and control methods that enable them to meet their responsibilities most cost-effectively.

The amount of pollution a facility emits should not be determined by market forces

With emission trading, individual facility emissions are determined only partly by market forces. There are two other determinants as well:

- the overall emissions cap or reduction imposed on the group of participating facilities
- any local air quality thresholds or criteria incorporated in the trading rules.

The significance of the former is that for every increase (or non-reduction) in emissions at one facility there will be an equivalent, offsetting decrease in emissions at another facility. The "losses" at one source are balanced by "gains" at another. The significance of the second determinant is that trades that might threaten air quality in particular locations can be prevented by the trading rules.

The larger question is to ask how indeed facility emissions should be determined, or more accurately to ask on what principles the present distribution of pollutant emissions among emitters in any area, established for historical reasons, should change in future. Command-and-control offers one set of principles, emission trading another. A combination of the two may offer a third. The best choice will depend on the situation.

3. EMISSION TRADING EXPERIENCE TO DATE

Experience In Canada And The United States

Canadian experience is limited to within-firm trading of sulphur dioxide and nitrogen oxide emissions among six Ontario Hydro fossil-fuel generating plants. Ontario's "Countdown Acid Rain" program imposes on Ontario Hydro a schedule of reductions in total emissions of these pollutants from 1986 to 1994. This program, which allows internal adjustments among the 28 boilers involved, has helped Ontario Hydro to meet its obligations in a cost-effective manner. No cost data are available. However, a technical report on how Ontario Hydro could meet future nitrogen oxide emission targets has estimated savings of 17% to 31% by internal trading compared to a uniform emission standard.

Virtually all other experience with emission trading has occurred in the United States. The United States experience, consisting of several national and numerous local programs dating back to 1976, has been described for the Working Group in the report commissioned from Barakat & Chamberlin. The analyses show that emission trading programs have been successful as a means of having environmental concerns and costs incorporated in corporate decisions. The results will now be summarized for a number of national programs and for a series of case studies of regional programs.

National Programs: Allowances

There have been three U.S. national emission trading programs: for lead in gasoline (completed), CFCs (currently operating), and sulphur dioxide (planned). All three are allowance programs, that is, trading replaces command-and-control for all sources as in the standard emission trading model described in the previous chapter.

Lead in gasoline

In 1982, to accelerate reduction of lead levels in gasoline, refiner-by-refiner regulation was replaced by lead allowance trading, enabling a refiner to exceed its limits if it acquired corresponding emission authorizations from another refiner. By

the end of the program over half of all lead allowances were being traded. By 1988, lead levels had been reduced to target concentrations, and the refining industry had achieved large savings in costs compared to the command-and-control alternative. Though systematic data on these savings were not collected, the U.S. Environmental Protection Agency estimated that the lead trading program might reduce the refining industry's total compliance costs by as much as $228 million.

CFCs

Following the Montreal Protocol on sources of stratospheric ozone depletion, CFC producers have been allocated allowances in quantities initially based on historical data and afterwards declining annually. These allowances can be freely traded among producers or other interested parties. Data on cost savings that result are not yet available, but early estimates were that the use of trading would save about half the cost of an equivalently effective command-and-control system.

Sulphur dioxide

The goal of this acid rain reduction program is to reduce total annual sulphur dioxide emissions by 10 million tons (more than half) below 1980 levels. The implementation rules are still being developed and are expected to be adopted in May 1992. Noteworthy features of the proposed program include the following:

- About 3% of annual allowances will be held in reserve, of which 80% will be distributed in a "revenue-neutral" auction. This will not only reduce barriers to new entrants but also ensure that all sources engage in some action (emission reduction or allowance trading) to comply.
- Non-utility sources will be allowed to opt in to the program.
- Standardized forms and administrative requirements will be used in all states to equalize administrative burdens.
- Program planning involved consultation with affected interests.
- Compliance costs by the year 2010 will be about half those of an equivalent command-and-control program, a saving of $10-14 billion; these savings will be achieved with an increase in industry administration and monitoring costs of less than $1 billion and an increase in government administration and monitoring costs of about $30 million (excluding government savings from no longer having

to revise BACT standards periodically). If fees were implemented to cover government administration costs, they would be only a small fraction of the overall compliance cost savings.

Case Studies Of Local Programs: Reduction Credits

In the United States there are about 30 local emission trading programs, which conform to and go beyond federal guidelines. All of them use "emission reduction credits" (ERCs) and are therefore more restricted than allowance programs. ERCs are mainly used in conjunction with command- and-control regulation as a supplement which enables new or expanded facilities to purchase allowable emissions from existing facilities when the total allocation in the region is fixed.

Barakat and Chamberlin studied five of these local trading programs: three in California, one in New Jersey, and one in Kentucky. The detailed results of their analysis would be useful in the design of trading programs in Canada. It is the summary results that are of interest here.

Cost savings

Estimates of the accumulated savings from U.S. emission trading programs through 1989 range from $10 billion to $13 billion, based on a total of 7000-12,000 trades. Ten studies of specific scenarios, comparing estimated costs of command- and-control and economic incentives such as emission trading, show the former more expensive than the latter in each case, ranging from slightly more, to four, six, fourteen, and even twenty-two times more costly.

Factors important for success

A variety of characteristics were found to be associated with a successful trading program:

- Clearly defined goals
- A high ratio of source participation
- Accurate emissions inventories
- Clear and comprehensive compliance requirements
- Credible enforcement threat
- Predictable and efficient administration
- Effective emissions banking

- Self-supporting administration
- A single authority for air quality and emission trading
- Economic growth
- Champions within and outside the regulatory agency
- Stakeholder participation in program development.

These conclusions would also assist in the design of an emission trading program in Canada.

Program evaluation

Barakat & Chamberlin point out that a basis for program evaluation should from the outset be part of the plan for an emission trading program. Evaluation should be of two kinds: impact (the effects of the program) and process (the implementation of the program).

- Impact evaluation: measures include:
  - Achievement of air quality goals
  - Accommodation of economic growth
  - Compliance cost savings
- Process evaluation: measures include:
  - Volume of trading activity
  - Trading process efficiency (time lags, approval rates, costs)
  - Frequency of revision of rules.

Particularly in the case of an experimental or pilot project employing emission trading it would clearly be vital to have the evaluation criteria and their measures specified from the beginning.

4. POLICY AND DESIGN ISSUES

Is Emission Trading An Effective Method Of Air Management?

Issue

The Working Group was asked to investigate the emission trading concept and experience and recommend whether it deserves consideration as an air management option.

Discussion

For those environmental problems to which emission trading can be applied, it offers significant advantages over the usual system of command-and-control regulation. For industry it means much lower total abatement costs, more management options, greater freedom to make decisions. For government it offers reduced economic impact for a given level of environmental improvement, accelerated fulfilment of goals, and, as atmospheric standards become more rigorous, increased savings in administrative costs. The public in turn will ultimately benefit from accelerated environmental improvement and the cost savings of industry and government.

Emission trading will not replace command-and-control regulation. In the right circumstances, a good emission trading program offers many advantages over a command-and-control approach. In other situations, as with regulation of toxics, emission trading is often not appropriate. But, as American experience shows, emission trading programs have been effective even when employed as last resorts in less-than-ideal combinations with command-and-control methods. In fact, the trend in American practice is to reduce restrictions on emission trading and give it more chance to show its effectiveness.

RECOMMENDATION:

- CCME should endorse the concept of emission trading as a potentially valuable instrument of public policy for air management.

Program Design: Program Goals And Pollutant Characteristics

Issue

What are the key factors, or decisions, that determine the design of an emission trading program?

Discussion

The trading rules of an emission trading program depend on whether the goal of the program is to maintain air quality at current levels or to improve air quality. The main difference will be in the sizes of the emission allowances. In a maintenance program they will remain constant, whereas in a reducing program they will be set to diminish at a scheduled rate that is either common to all emitters or varying among them. Other differences include the need in a reducing program for special rules for the sale of allowances relating to plant shutdowns.

The trading rules are also determined by the characteristics of the pollutants in question. There are two main pollutant questions:

- Differences in severity and locality of impact: When pollutants have severe, local impacts, as do toxic chemicals, the goal is to minimize or eliminate their release, so that a trading program may be inappropriate and command-and-control regulation necessary. Where pollutants have virtually no local impacts, such as carbon dioxide, trading brings no local inequities and may be entirely appropriate. Many pollutants, including NO_x and VOCs, are somewhere between those extremes: they have local impacts, but potential inequities from trading (where emissions are reduced at some sites but not at others) can be limited or are negligible when compared to the potential for overall improvement in air quality. For these mid-range pollutants the trading program's rules could establish interpollutant or interdistrict trading ratios, limit trading distances, stipulate maintenance of air quality standards, and so forth to ensure that trades do not create local clustering of heavy emitters or other local inequities or hazards.
- Uncertainty about impacts: Knowledge and scientific understanding of pollutants and their impacts on health and the environment are progressing continuously. The quality of data on emission rates and on local exposure levels is also advancing rapidly. All these sources of information will continue to improve while an emission trading program is under way. Any program is therefore vulnerable to changes in requirements and rules based on new knowledge. A maintenance

program may have to become a reduction program; a traded pollutant may be reclassified as a toxic or be found in some processes to be generated along with toxics; new air quality standards may impose unexpected restrictions on trades. Changes like these reduce the economic value of the emission allowances. Unless all participants understand this possibility, some allowance owners may believe that they deserve compensation for the loss in values. Program designers thus should make clear that emission allowances do not really confer "property rights" in the normal sense but rather provide limited authorizations for certain transactions, authorizations that are not perpetual but subject to withdrawal or modification based on developing information on pollutants and their effects.

Conclusions

- The trading rules developed in an emission trading program must be tailored to the specific air management goal(s) of the program and must reflect the characteristics of the pollutants covered by the program.
- Emission allowances granted by an emission trading program must be made clearly conditional or time-bounded to ensure that the program does not conflict with future air management requirements.

Scope Of Market: Sources

Issue

What principles should be considered in deciding how many sources, how large or diverse a trading population, should be included in an emission trading program? Are there principles of exclusion?

Discussion

With certain reservations to be mentioned, the broader the market the better. Increasing the number of sources and the variety of types and sizes of sources participating actively in the program brings important advantages. In particular, it:

- increases the potential savings in emission reduction costs attainable by participants
- reduces the potential for anti-competitive behaviour by existing sources

- increases the opportunity for continued economic growth in the trading area
- increases the trading program's environmental effectiveness and its contribution to air quality.

We look at each of these in turn.

An emission trading program helps minimize total emission reduction costs among its participants by allowing sources with high reduction costs to purchase surplus emission allowances from sources with low reduction costs. For this to happen, there must be variations in reduction costs among the participating sources. Usually there is considerable variation in reduction costs even among sources of the same industry or type, because of differences in production processes or because some have newer or more efficient equipment than others. Much greater differences will be found between sources in different industries or between point sources (eg smokestacks), non-point sources (eg open-air evaporation), and mobile sources (eg vehicle exhausts). Thus the number and size of trades will likely increase with the number of sources participating in the program and the greater their variety. Since each trade represents a cost saving by definition (because if there were no saving the trade would not occur), this increased trading activity results in increased cost savings.

As the population of participating sources becomes more numerous and more varied, the less likely it is that the total emissions covered by the program will be highly concentrated in a few sources. Such concentration could result in anti-competitive practices in the market for emission allowances. For example, NO_x and VOCs emissions in the Greater Vancouver Regional District come primarily from mobile sources (NO_x 80%, VOCs 53%) and secondarily from stationary point sources (NO_x 20%, VOCs 47%). Unlike the dispersed mobile emissions, the point source emissions are highly concentrated: for NO_x emissions one site accounts for 30% and 15 sites for 79%; for VOCs, 3 sites account for 58% and 16 sites for 85%. An emission trading program in the Lower Mainland for NO_x and VOCs which was restricted to point sources might find the relatively few existing sources holding back from trading in an attempt to drive up the price of surplus emission allowances. But if the market were broadened to include the mobile sources, the potential for anti-competitive practices would be virtually eliminated.

While broadening the market lowers the price of emission allowances by bringing in a greater number of low-cost reductions and overwhelming any anti-competitive tendencies, it also increases the supply and flow of surplus

emission allowances for sale, making it easier for new sources preparing to enter the area to find and buy the allowances they will need to cover their new emissions. In this way, broadening the market also assists economic growth in the trading region.

The broader the market, that is, the greater the ratio of participants to total sources, the more effectively the trading program will contribute to air quality or emission goals. This is not only true in the self-evident sense that a program covering only 10% of emissions could not possibly, however successful, make a large contribution to the total problem. There is also some evidence that the more comprehensive the emission trading program, the more effectively the total problem is solved. In the American cases studied, when trading covers only a small portion of total emissions, overall air quality continues to suffer, as growing emissions from non-participants outweigh the considerable successes within the small trading programs. On the other hand, the American leaded gasoline phase-out, conducted through a trading program which included all sources, achieved its goals successfully at substantial cost savings. If emission trading is worth doing at all, it is worth even more when done well.

Nevertheless, there can be limits on how wide the market should be. Some limits affect the types of sources that should be included, other limits affect the types of trades that should be allowed. Not eligible would be sources whose creation or use of surplus emission allowances cannot be quantified, monitored, and enforced. Including such sources would increase the potential for "paper trades", where emission allowances are sold without the necessary reductions being made. Also not eligible should be particular trades that would conflict with other environmental standards or regulations. For example, a trading program to control total SO_x deposition should disallow trades that could put at risk local ambient air quality standards for SO_x.

But case-by-case consideration can also create exceptions to the exceptions. For example, a trading program for VOCs might make a point of including sources whose emission of VOCs was linked to the emission of toxic gases that are independently subject to control or elimination. The direct regulation of the toxic emissions would in effect control or reduce the rate of emission of VOCs, outweighing the economic incentives of the program and preventing the emitter from participating as a purchaser of allowances. But the emitter could participate as a seller, helping finance the costs of the added controls for the

toxics by selling the surplus VOC emission allowances created as a result of those added controls.

Conclusion

- An emission trading program should include all sources in the trading area (point, non-point, and mobile) which are able to show that the creation or use of a surplus emission allowance:
  - can be adequately quantified, monitored, and enforced
  - would not violate any other environmental standard or regulation.

Scope Of Market: Pollutants

Issue

Should an emission trading program include more than one pollutant? To what extent should interpollutant trading be allowed?

Discussion

Expanding a program from one pollutant to two is another way to broaden the scope of the market. Doing so adds the sources which emit the second pollutant but not the first, bringing the benefits of a wider population of participants. All sources increase their trading activity. A trading program, once established, can easily be expanded to encompass other pollutants. Moreover, some air management problems require joint management of more than one pollutant. For example, control of low-level ozone requires control of the emissions of its precursors, NO_x and VOCs.

However, gains are limited if, say, two pollutants in a program cannot be mutually traded; in that case there are really two separate programs attempting to share the same administrative infrastructure. But if a trading ratio between the two pollutants can be established, sources emitting only the first pollutant can exchange with those emitting only the second pollutant while sources emitting both pollutants can trade fully with the others. In effect this creates a single composite pollutant traded by everyone,

From a strictly chemical standpoint interpollutant trading will be a frequent occurrence because often a designated pollutant is itself an aggregate. For example, the category VOCs (volatile organic compounds) consists of a wide

variety of chemicals often released into the atmosphere together because they tend to be generated in various combinations during fossil fuel combustion. A "VOCs" trading program may thus be implemented with trading ratios between individual gases established to reflect environmental equivalencies.

Eligibility for trading will depend essentially on pollutant characteristics. For example, not all "VOCs" may be tradable. Benzene, a volatile organic compound, is usually classed as a toxic chemical, subject to command-and-control regulation. It would probably be excluded from a trading program. From time to time other chemicals may be reclassified as toxic and withdrawn from trading. If a newly identified toxic withdrawn from trading happened to be generated and emitted inseparably from other pollutants that remain tradable, the command-and-control restrictions on the toxic fraction would reduce actual emissions of the associated tradable pollutants to a level below the allocated allowance for those pollutants. The result would be a surplus allowance of those remaining tradable pollutants, whose sale could help finance the newly imposed command-and-control modifications.

Other pollutants may be tradable subject to air quality criteria. Trading between these and other pollutants not so restricted can be conducted according to trading rules designed to ensure equivalence or case-by-case evaluation and approval. For example, to control acid deposition, consideration should be given to trading between SO_x and NO_x, as is being considered for the American acid rain program and has been done with the acid emissions cap imposed on Ontario Hydro.

Conclusions

- Interpollutant trading rules should be incorporated to include within a program as many pollutants as can be assigned environmental equivalences.
- All air pollutants should be considered potentially eligible for inclusion in emission trading programs except those classed as having unacceptable local impacts (eg toxic, reactive, explosive).

Scope Of Market: Levels Of Trading

Issue

Emission trading can occur inside firms (within sites, between sites) as well as between firms. Most discussions of emission trading focus on issues involved in trading between firms. Do the intra-firm levels have a separate and independent value worth consideration even if between-firm trading is inappropriate?

Discussion

Emission trading between firms usually implies that emission reassignments at the lower levels are already possible and occurring. If a firm with two sites buys emission allowances, the implication is that all the firm's emissions of the pollutant at all the firm's sites are being summed. Even if there are restrictions on exchanges between sites within the firm, the implication is that all the emissions at each site are summed. These forms of emission trading between point sources within a site and between sites within a firm actually occur as management decisions and are only "trades" by analogy. Nevertheless, the majority of emission reassignments may occur at these lower levels.

Emission trading between firms would make little sense without these lower-level "bubbles" over sites and firms. (Why should trading occur between exhaust stacks at two sites but not between multiple stacks at each site?) But even in the absence of trading between firms, site and firm "bubbles" can be created and bring benefits. They allow firm management to have its own internal emission trading program, maintaining or reducing the firm's total emissions by the most cost-effective combination of internal measures. Compared to command-and-control standards for each point source in a site or a firm, the creation of bubbles and internal emission trading may mean for the firm large savings and diminished intervention. Yet their creation entails far less government involvement and institutional development than a full between-firms emission trading program. Many of the issues discussed in this report for a full program simply would not arise for schemes internal to firms. Therefore, emission trading within a site or between sites within a firm has value not only as a basis for full, between-firms emission trading but also independently as a significant management tool for emission control and reduction.

Conclusion

- Emission trading limited within a site or between sites within a firm has important independent value and should be considered in many situations where full, between-firm emission trading may not be appropriate.

Initial Allocation Of Emission Allowances

Issue

What is an "initial allocation," and why is it necessary? What options are there, and how do they compare?

Discussion

In an emission trading program the participating firms buy and sell surplus emission allowances. To enable the program to begin, a sum total of emission allowances will have to be distributed, like playing cards, to the participants. This distribution is the "initial allocation", around which several issues arise, including how much the total should be and how the distribution should be made.

Ideally, all emitters in an airshed would participate, and the total of their emissions would be accurately known. In this ideal case, the allocation problem would be to distribute the total quantity among all the emitters. However, in practice, often only a portion of the emitters will participate (usually the larger ones at first), and though their own emissions will be known accurately, their share of the total emissions in the airshed, their share of total pollution, may not be known. In this more common case the allocation problem will be to allocate, among the participating emitters, allowances equal in quantity to their total emissions.

[An additional problem arises if the air quality in the airshed is poor, so that emission reduction is a goal. Does it make sense to allocate total current emissions if they are acknowledged to be excessive? This issue is discussed separately later.]

Since those receiving allowances will be acquiring portions of public resources as private assets, an important argument exists for allocating the emissions by auction. In this way the government, on behalf of the public, will receive the value attributable to their use by emitters. Furthermore, to distribute the allowances free to existing emitters would seem to give them an advantage

over future firms starting up, who in order to commence operations and emissions will have to buy the allowances they need from the existing firms who received them free. Finally, if an unprofitable firm hears that an emission trading scheme is being developed, what will prevent it from hanging on until the allowances are allocated and then closing down, enabling the departing owners to sell and make off with the value of some public resources they never intended to use?

On the other hand, to require participants to bid for allowances to continue emitting would deeply change the business environment and affect the long-term plans of emitting firms. Moreover, the change could be devastating: a firm would have to buy allowances or go out of business. Because there would be no choice, the bidding for the limited set of allowances, perhaps driven by firms seeking room for future growth, could send allowance prices soaring.

Nor would the entitlements purchased at such high prices seem particularly secure as long-term assets. If emission reduction is, or becomes, a goal, the allowances will undergo a scheduled depletion, diminishing in size by, say, 5% a year. Outright confiscation is also possible if authorities decide to promote competition by introducing an annual re-auction of a proportion of all allowances or to reclassify a traded pollutant as a toxic, henceforth subject to command-and-control regulation and no longer eligible for trading.

As to the effects of establishing an initial allocation of air emission allowances by auction, American experience is not helpful, because there have not so far been any such initial auctions in the United States. Whether because an initial auction would be unacceptable to industry or would raise costs enough to outweigh the expected economic advantages of a trading system, the rejection of initial auctions in the United States is noteworthy.

Both the "free" and the "auction" options thus have disadvantages. A third option is to modify the free model to incorporate fees and other requirements to achieve environmental objectives, as will be discussed next. The imposition of fees and other levies can capture for the public some of the value of the common resources privately acquired. For example, most air management districts in the United States impose fees based on the quantities of pollutants emitted, and excise taxes have been levied on ozone-depleting substances as part of the CFC phase-out program.

[The initial allocation auction discussed and rejected here should not be confused with the option of later "revenue-neutral auctions" held during the program's operation discussed below under "Maintaining a Competitive Market".]

Conclusion

- The initial allocation of allowances should recognize existing emission sources and not be carried out by auction.

Structuring The Initial Allocation

Issue

How should the total emission quantity to be allocated be determined? How could the allocation take account of performance differences between sources? Is it advisable to have new sources meet certain performance standards?

Discussion

If the program goal is to maintain existing air quality while accommodating future economic growth, an allocation based roughly on current emissions is sufficient. The exact meaning of "current" will have to be carefully considered. Since emissions vary, a representative historical period (or periods) must be selected for emissions to be averaged. This period must be recent enough to reflect present levels but not so recent that firms may have increased their emissions artificially in anticipation of the allocation. Fluctuations due to business conditions will have to be incorporated. These and other technical problems must therefore be addressed.

A more interesting issue arises if the program goal is emission reduction. This means, in effect, that the initial allocation is too generous. If all emitters were at an equivalent technological level or had roughly equal emission reduction costs, it would not be unfair simply to stipulate that the allowances will diminish in quantity annually according to a given schedule until the stated maintenance level is reached. In that case each emitter would contribute its share to the reduction and spend its share of the total cost. The difficulty is that emitters are unequal in just these ways -- which is why an emission trading program is needed and able to save costs. The problem is to make the allocation in a way that does not reward firms that have lagged in curtailing their emissions. How, therefore, should a free initial allocation be conducted when emission reduction is the goal?

The allocation might be made, not on the basis of historic emissions (which are acknowledged to be too high overall) but rather on the basis of a target allocation (the quantity an emitter would release if it met some criterion of current

good practice, such as "best available technology" or "new source performance standards"). This would be a shock, because retrofitting improved control technology is expensive, and some of the firms may not be in the best economic health to begin with. In any case there would be a time delay while firms came into compliance.

A better approach is to accept the inevitability of a transition period and use the capabilities of emission trading during that period to accelerate compliance. In one version of this approach the transition period is fixed, and all firms will reach their target allocation by a certain date. In another version, the initial allocation for all firms declines at a fixed, rapid rate until each firm reaches its target allocation, so that the transition period depends on the firm, being longest for the firms who are furthest from their target.

Table 5 and Figure 1 show these two methods of using emission trading with a transition period to phase out obsolete equipment. The three firms are the same size, but C is the newest and actually conforms, let's say, to the New Source Performance Standards, representing best available technology. In both cases, Firm C has an emission allowance that decreases at 2% a year. Firms A and B are older, heavier emitters who have received higher initial allocations based on their current emission levels.

- In Plan 1, the transition period is fixed at five years, so the rates of reduction vary. A's emission allowances drop rapidly at 8% a year, while B's drop at 5% a year, so that after five years all have the same allowances, and from then on any further reductions in allowances apply equally to all firms.
- In Plan 2, the rate of reduction is fixed at 5% so the transition periods vary. The older plants are penalized at 3% a year above the standard 2% rate, so their allowances drop steadily at 5% a year. But A, which has to make the greater reduction than B, has a longer transition period. B joins C after 6 years, and A joins the other two after 13 years.

Obviously other variations are possible, but the principles are that there is a transition period, that emission trading occurs during the transition, and that special temporary trading rules are applied to address the unfairness of granting initial allowances for current emission levels.

The emission trading program begins with the initial allocation and is fully implemented during the transition period. The steep annual reductions imposed on Firms A and B are not reductions in actual emissions but reductions in emission

TABLE 5: INITIAL ALLOCATION AND TRANSITION PERIOD

Plan 1: Fixed transition period, variable reduction rates:

Allocation (tonnes/y)	Target allowances in 5 yrs (tonnes/y)	Total reduction (tonnes/y)	Total reduction (%)	Annual reduction (%)
Firm A: 75	45	30	40	8
Firm B: 60	45	15	25	5
Firm C: 50	45	5	10	2

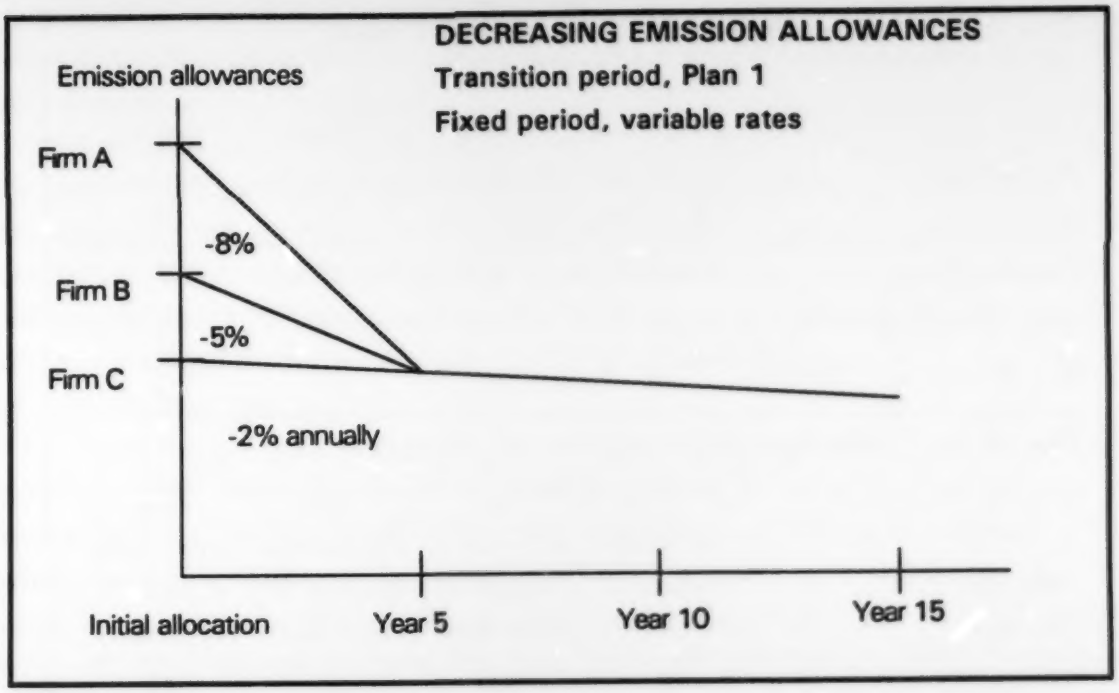
Plan 2: Fixed reduction rate, variable transition periods:

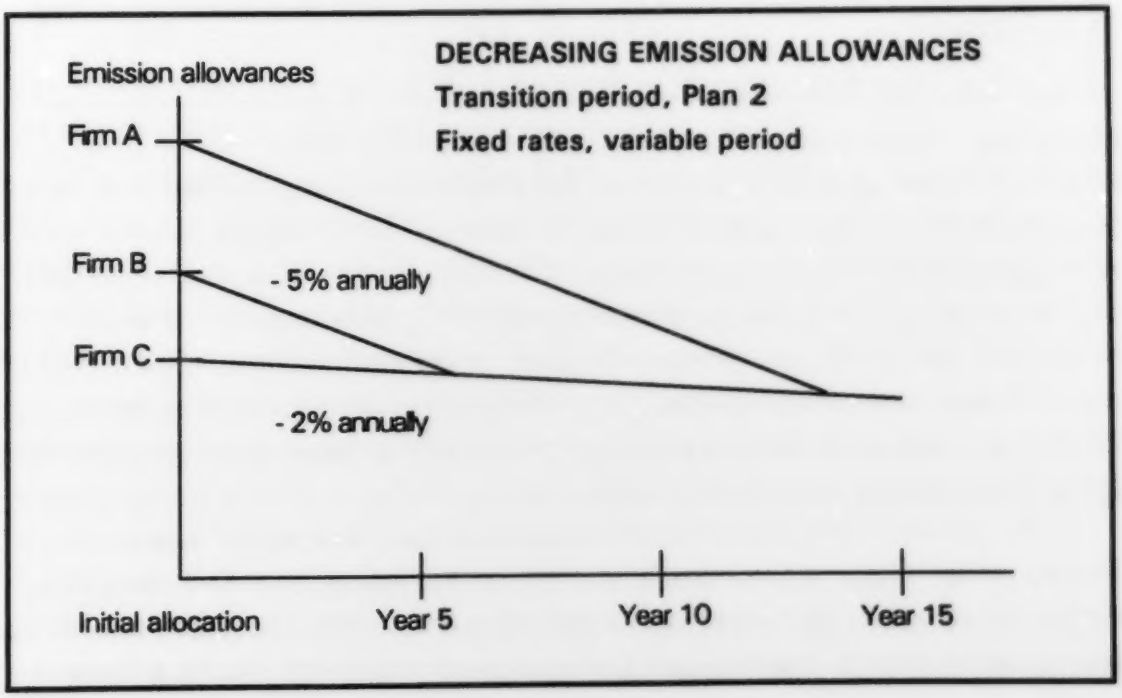
Allocation (tonnes/y)	Annual reduction (%)	Total allowances at year 5 (tonnes/y)	Total allowances at year 10 (tonnes/y)	Total allowances at year 15 (tonnes/y)
Firm A: 75	5	58	45	37
Firm B: 60	5	46	41	37
Firm C: 50	2	45	41	37

allowances. Under either plan, for example, A might still actually be emitting 75 tonnes a year after five years. If so, under Plan 1, A would by then have to be purchasing 30 tonnes of emissions allowances to cover the excess; under Plan 2, A would by then have to be purchasing 12 tonnes in allowances. The availability of those surplus allowances for A to purchase simply means that other emitters in the system had carried out excess reductions of that amount, and A found the purchase cost lower than the cost of installing new control technology itself. When this happens, there are savings overall for an equivalent emission reduction, and emission trading is performing as it should.

By contrast, American practice has been to require all emitters to meet target standards before participating in emission trading. In most U.S. programs, emission trading has been used to maintain air quality while allowing economic growth rather than to improving air quality through reductions in total emissions.

FIGURE 1: INITIAL ALLOCATION AND TRANSITION PERIOD





The foregoing examples show how emission trading can operate effectively in an emission reduction program as well. Thus there is no reason to require new entrants into an emission trading program to meet New Source Performance Standards in advance. This requirement cannot affect the level of total emissions, which is set by the total quantity of allowances. The requirement compels new entrants to make reductions rather than allowing the reductions to be made simply by those emitters, new or existing, for whom they cost the least.

Conclusions

- The initial allocation could be based on a historical averaging of actual emissions over a selected period, and a transition period could be used to bring existing sources to a common emission standard by accelerated reduction in their emission allowances.
- New sources should be required to purchase the emission allowances they need.
- Within social and legal constraints, the maximum economic benefits will be achieved where new sources are not required to meet pre-set technological standards before trades are allowed.

Fairness Between Sources Inside The Program And Sources Outside

Issue

In many cases an emission trading program will include only part of the total population of emitters of a particular pollutant. For example, consider a program in which large and middle-sized stationary sources are included but not the mass of backyard barbecues or automobiles. The sources within the program thus account for only part of the total emissions and thus of the pollution problem -- often a small part. Even big improvements by participants in the program thus may not have a large effect on the total problem. But program participants are easy to identify and mandate for improvement. What can be done to prevent participants in the program from being unfairly targeted for additional efforts?

Discussion

Because of the open information base with which emission trading functions, the performance and successes of program participants will be especially visible. When program participants contribute only a small part of total

emissions, the combination of a successful program within a persisting air quality problem is predictable -- as American experience shows. Also predictable is the resulting tendency to try to accomplish the utmost among those with a good track record, even though program participants may believe that they have already done more than their share.

Both equity and efficacy require that the program be broadened to cover more of the total population of emitters. This can be done in two ways. New participants can be added by category and also by allowing voluntary opting-in to the program by any emitters. Secondly, current participants can be allowed to find non-participating sources from whom allowance-equivalents can be purchased. An example from California is the "beater buy-back" program, in which refineries gain emission reduction allowances by purchasing and destroying old automobiles with high exhaust emissions, with the allowances calculated on a formula relating measured emissions against average fleet emissions for the same auto type. Measures of this kind, while not alleviating the public pressure on program participants, nevertheless give them more sources to deal with as well as allowing the program to tackle a greater proportion of the overall air quality problem.

Conclusions

- Complementary control programs should be implemented for sources not included in the trading program.
- The trading program must have the flexibility to accept additional types of sources as it becomes possible to quantify, monitor, and enforce their emissions.

Regional Imbalances

Issue

If emission trading occurs between different regions, could one region gain improvements at the expense of higher emissions in the other? Are there cases where this could be desired? What can be done to encourage or prevent such large-scale shifts in emissions?

Discussion

It is to be expected that emission trading would lead to a rather random geographic unevenness in improvements, with allowance sellers and purchasers

broadly distributed. But it could also lead to a gradual large-scale net geographic shift of emissions in one direction or towards one area or region. This net shift could happen if emitters facing expensive control methods tended to be located in one area or region while emitters enjoying less costly control methods tended to be located in another. Surplus emission allowances would then tend to be created in the latter region and sold to the former region, shifting net emissions towards the former region. These large-scale shifts could develop if there were significant differences between regions in industrial base (implying different technologies and control costs) or in economic growth (implying differences in demand for allowances).

These large-scale differences should be considered by the authorities responsible for the design of the emission trading system. Net shifts of this kind are not difficult to prevent by adaptations of the trading rules. In fact, system designers often promote such shifts in certain circumstances. For example, if the airshed has a prevailing wind, the trading rules might encourage reductions in upwind regions, in effect shifting net emissions into downwind areas. This would be done because upwind emissions have greater impacts in the trading region than downwind emissions. A variety of mechanisms can be used to encourage net emission shifts where they are wanted or discourage them where they are not wanted. They include trading ratios between subareas or outright prohibitions on trades in certain directions between specified subareas. The same techniques can be used to prevent the development of undesired regional emission imbalances.

Conclusion

- Program designers should consider the potential for desired and undesired net shifts of emissions between areas or regions and incorporate mechanisms to encourage or prevent them as necessary.

Banking Of Surplus Emission Allowances

Issue

What is emissions banking? What different kinds of banking are possible? Should banking be allowed? Should limits be placed on it?

Discussion

Banking refers to the status of surplus emission allowances from the time they are created or purchased until the time they are sold or used. Because there will always be some time delay between creation or purchase and sale or use, some minimal degree of "banking" is inherent in any emission trading program. For example, an emitter may notice that a lower-than-expected rate of emission will leave a surplus in its annual allowance, so that the firm is informally holding and accumulating some surplus emissions. But formal banking of allowances as a program option does not refer to this informal and private holding of surpluses.

With banking, an emitter publicly identifies and registers a quantity of emission allowances as surplus. The banking rules then allow certain things to be done with this registered surplus that cannot be done with informally held surpluses.

Emission trading programs have to impose an interval or period within which allowance use is calculated, making possible the identification of a "surplus" of allowances over use which can be traded. This period is usually a year but sometimes is shorter if emission peaking is a problem and can be longer (as in sulphur dioxide programs) if the main concern is longer-term loading. When the period ends, total allowances are matched with total emissions, the slate is cleared of unused allowances, and the process repeats. Since all allowances have to be accounted for within the period, the problem facing informally held surpluses is that unless they are sold before the period ends they will be lost to the holder. With banking, the holder of surplus allowances can retain those rights into the next period.

Two kinds of banking can be involved. Suppose the firm this year is allocated allowances for 1000 tonnes of contaminant *x*, emits only 900 tonnes this year, and banks the surplus of 100 tonnes. With quantity banking, those 100 tonnes of surplus emissions allowances can be used next year, either by the firm itself (which can then emit 1100 tonnes) or by another emitter which buys them. Quantity banking raises the possibility of annual variations in emissions rates if rates of saving (postponing) and withdrawal (use) vary, and so it is used in programs where annual emission rates are less important than long-term totals. With rate banking, it is the right to receive annual allowances for 100 tonnes that is banked. Rate banking implies annual reassessments of emission allocations based on the previous year's emission levels. Rate banking enables a firm to make

temporary reductions in annual emissions without forfeiting the right to the allowances involved. For example, the emitter mentioned above, by banking the 100 tonnes of unused allowances as a rate, retains next year the right to receive allowances for 1000 tonnes again rather than for only 900 tonnes. Rate banking will therefore be more heavily used in programs that focus on encouraging reductions in annual emission rates, usually in support of air quality objectives.

To incorporate banking into emission trading brings several advantages:

- Accelerates adoption of emission abatement measures: Without banking, an emitter would have no incentive to reduce emissions to create a surplus that could not be used or sold immediately. The value of a surplus to a prospective purchaser would be much less if it had to be used immediately. With banking, sources do not have to wait until a prospective buyer of surplus allowances is found before undertaking emission reductions. Without banking, an emitter anticipating future expansion or tightened emission reduction requirements would tend to postpone emission reductions simply to retain current rights until they were needed.
- Lowers trading costs by helping identify surpluses for sale: Though not all banked surpluses will be available for purchase, and although informally held surpluses can be identified from monitoring programs, nevertheless the bank will be the place where prospective purchasers start to look for allowances. Banked surpluses will be more probably available than informal surpluses, and the firms banking most actively will tend to be those trading most actively and in the highest volumes.
- Shifts emissions to more environmentally favourable times: When emissions are a seasonal concern, such as ozone during summer months, banking systems can encourage emitters to reduce emissions during peaks and shift the allowances to off-peak times, such as winter months. Such shifting might have to be controlled by ambient air standards to prevent the creation of new problem peaks in "shoulders" and off-peak periods.

American experience with emission trading has shown not only the great value of banking systems but also the impairment caused when certain practices undermine banking by singling out banked surplus allowances for devaluation in various ways. Apart from occasional outright confiscations by authorities eager to cut emissions at any cost, banking is damaged by time limits placed on the length of time a credit can be banked or by discounts on the allowances placed in banks.

The substantial loss of economic value in having resources tied up as an inventory of surpluses in a bank should be enough of a disincentive against lengthy holding of credits. Furthermore, rather than imposing a discount on banked surpluses (so that for every 1 tonne banked only, say, 0.8 tonnes can be withdrawn), the appropriate emission reduction incentive is to reduce the value of all allowances by a fixed amount annually, so that banked surpluses will share in the general decline of value rather than being singled out for special treatment. Banking, in short, is undermined by measures that reduce the confidence of depositors of surpluses that their deposits will be safely held. Banking, after all, is voluntary and depends on trust.

Conclusions

- Emission trading programs should establish banking systems and rules for surplus allowances. The rules involved (eg quantity or rate banking) should be designed to reflect program goals and pollutant characteristics.
- The banking rules and system will be most effective if they express a commitment that surpluses deposited will be held safely and not singled out for confiscation, discounting, or time-limitation.

Maintaining A Competitive Market

Issue

The cost savings made possible by emission trading depend on the market for allowances being active and competitive. The desired kind of market could be blocked by barriers of three types: an inability of willing buyers and sellers to identify each other; cumbersome or confusing trading rules; and hoarding of permits by one or a few large firms. How can the trading rules eliminate such obstacles?

Discussion

Buyers and sellers can be brought together in three ways. The allowance banks will reveal which emitters have formally declared surpluses, some of which may be for sale. The same emitters may have additional undeclared surpluses available as well. The regulatory authority will record, and can make public, ongoing reports of emissions made and allowances held by all emitters.

Examination of these reports will reveal the names of emitters who may have surplus allowances. Finally, brokers can become knowledgeable about the market and help arrange transactions for a commission or a fee. The trading rules should encourage all three methods.

Cumbersome or confusing trading rules can create so many difficulties, delays, and costs that trading is discouraged. Program designers should bear in mind that the easier it is to trade, the more effective the program will be. One area where transaction costs can mount is in requirements for prior approval of trades. Where possible, approval requirements should be streamlined; for example, in some American programs demonstrations by air dispersion modelling that air quality standards will be met have been replaced with simple predefined geographic grids stating trading ratios and other conditions that apply to trades between grid cells. Trades requiring approval can be allowed to proceed subject to later approval and possible rescission with penalties if approval requirements have not been met.

One or a few firms representing a large share of the total market may see benefits in buying up more allowances than they need in order to raise prices and make it difficult for new firms to enter the market or for some existing ones to survive. But this hoarding of shares cannot be simply proscribed because there is no way to distinguish surplus allowances held for authentic business purposes from hoarded allowances held for anti-competitive purposes.

If hoarding is feared in advance or suspected during an emission trading program, several remedies can be undertaken. Publication of the data on firm emissions and allowances held will reveal firms with an inexplicably large number of allowances compared to their emissions, and lead to public questions of a kind most firms prefer to avoid. Suspicions of hoarding behaviour would give additional reasons (beyond the economic advantages) for widening the scope of the market to enlarge the population of participating emitters and allowance. Emission fees, if they exist or are introduced, could be based not on actual emissions but on emission allowances held, thus imposing an extra burden on firms holding allowances much beyond their actual emissions.

Government might also consider holding regular "revenue-neutral auctions" of a fixed percentage of total allowances, as is planned for the American SO_2 emission trading program. Government would confiscate, say, 5% of each firm's allowances every year and make them available in a sealed-bid auction. The proceeds of the auction would then be returned to the emitters in proportion to the

allowances confiscated (hence "revenue-neutral"). Nothing would prevent a large anti-competitive firm from buying back its own allowances, but to be sure of regaining them the price bid would have to be high -- perhaps higher than the price received back for the same allowances. This method not only opens up a substantial quantity of allowances every year to which potential entrants can have access but also imposes a financial penalty on anti-competitive behaviour.

Conclusion

- To maintain a competitive market in emission allowances, trading rules should establish measures to help bring buyers and sellers together, minimize transaction costs while maintaining environmental standards, and prevent hoarding of surplus allowances.

Shutdown Credits

Issue

If an emission trading program is in place and the goal is emission reduction, should a firm shutting down forfeit its emission allowances? Does the answer depend on how long the firm has participated in emission trading?

Discussion

One consideration is the effect of forfeiture on the behaviour of firms contemplating shutdown. The prospect of confiscation would encourage a firm to cut production before shutdown to sell as many allowances as possible while still in business so that only a minimum amount will be abandoned. In fact, de facto cessation of operations may occur before the business is formally closed for just that reason. Such practices may or may not have desirable consequences in other areas such as employment.

A firm that decides to shut down shortly after the initial allocation occurs, if allowed to sell the recently acquired credits, would gain windfall benefits of a kind the program does not intend to provide. Some conditions may therefore be needed at a minimum, such as an interval after the initial allocation during which sales of a large portion of allowances would be prohibited.

Nevertheless, what should be done in the case of the firm that participates in the program in good faith but then decides to shut down? It would seem that a

division should be made among its total allowances between those it has a right to sell and those it does not. It clearly should have the right to sell any allowances it purchased. It clearly should not have the right to sell allowances representing the extent to which emissions exceed current good practice (eg during a transition period mentioned earlier), because those excess emissions reflect poor practice. A defensible position would be to allow the firm to sell that portion of its allowances equal to the amount equivalent to good practice (say, New Source Performance Standards) plus any allowances it had purchased.

Conclusion

- Constraints on shutdown credits should be developed to prevent windfall profits or abuse.

5. ADMINISTRATIVE ISSUES

Legislative Authority

Issue

Would an emission trading program be ruled out or prohibited in any area by existing legislation and regulations? If not, can an emission trading program be implemented by regulation under existing legislation, or will new legislation be required? Would it be desirable to have, and thus to introduce where it does not now exist, legislation explicitly authorizing the creation of emission trading programs? To what extent do the answers vary between jurisdictions?

Discussion

The Working Group does not know of any jurisdiction in Canada where emission trading is prohibited. However, regulatory structures under existing environmental legislation usually impose command-and-control and omit mention of emission trading as an option. In a situation where an emission trading program is precluded by existing regulations, the regulating agency can of course simply alter the regulations to make room for it.

It is equally important to allow for emission trading options in the longer-range and strategic commitments made in management plans. Thus the National NO_x and VOCs Management Plan explicitly permits the substitution of "environmentally equivalent" emission trading programs for the command-and-control programs it features.

In one Canadian jurisdiction, Manitoba, current legislation specifically empowers the government to implement emission trading programs by regulation, although no regulation or trading program has yet been implemented. The advantage of explicit authorization is that emission trading is publicly accepted as mode of environmental management. This formal acceptance provides useful support not only in various public arenas but also within government when seeking agreement on specific proposals among regulators themselves. Explicit authorization may therefore be desirable to obtain even in jurisdictions where, in the opinion of regulators, implicit authorization appears to exist. The possibility

that seeking explicit authorization might through legislative discussion arouse public opposition to the concept can be weighed against the value of educating the public about emission trading and winning their support for it as well as against the broader value of conducting environmental policy on openly discussed and accepted principles.

Conclusions

- Environmental management plans and regulatory proposals should not exclude emission trading as an option.
- Unless there are strong reasons not to do so, explicit legislative authorization for emission trading should be sought where it does not exist, even when there appear to be no current legislative obstacles standing in the way.

Monitoring And Enforcement

Issue

Compared to achieving similar emission reductions with command-and-control, would an emission trading program bring greater or different monitoring and enforcement requirements? Under an emission trading program would there be greater or different opportunities or incentives for abuse than under command-and-control? Put another way: would deficiencies in monitoring and enforcement cause greater or different problems for emission trading than for command-and-control?

Discussion

By increasing emission management options and by offering opportunities for substantial savings in emission reduction costs to industry, emission trading ought in a general way to make things easier for industry and may improve actual compliance. But it could also bring new opportunities for abuse, so the focus of enforcement will be different than with command-and-control. Moreover, as emission reduction requirements increase, the economic incentives for abuse will grow, increasing the cost of enforcement whatever the regulatory approach.

There is broad agreement that there will be a greater need with emission trading than with command-and-control for close monitoring -- in some cases for continuous monitoring -- of the emissions of those sources claiming reductions and

selling the surplus allowances. The sales value of the allowances will be a temptation for them to exaggerate the reductions expected; but if the reductions claimed and sold turn out not to have been made in reality, the purpose of the program will be defeated. Effective monitoring can prevent this from happening.

Furthermore, emission trading will introduce a second, additional domain of enforcement in the form of trading rules. These rules will apply in the administration of the trading system, which may include certification of program participants, evaluation and approval of trades, registration of transfers of emission allowances, and banking of surplus allowances. Incentives will exist for misrepresentation, for evading these trading rules.

The essentials of enforcement are the same between emission trading and command-and-control. Enforcement, whether of command-and-control requirements or of trading rules, naturally involves both monitoring systems for the detection of abuses and correction systems for the imposition of penalties. Effective enforcement will depend on a proper balance (which to some extent may involve optional tradeoffs) between monitoring effort and correction effort, a choice between making cheating difficult to do successfully and making it expensive if caught. For efficiency it would be desirable to make the penalties administrative rather than legal, that is, "tickets" rather than "summonses", though to establish administrative penalties may in some jurisdictions require special legislative authority. These points, while vital to effective enforcement, are the same for both emission trading and command-and-control regulation. (Possibly administrative penalties might be easier to apply with emission trading, because of the ability to focus enforcement efforts on a single criterion: the possession of sufficient emission allowances to cover actual emissions.)

The overall monitoring requirements may be greater for emission trading than for command-and-control, not only because of the additional need to monitor the trading system but also because command-and-control may offer alternatives to actual emissions monitoring. If certain equipment has been installed, certain practices and procedures are confirmed, and input data and mass-balance calculations allow estimates of emissions, the need for monitoring might diminish under command-and-control to a need for spot-checking. However, the validity of such surrogates for the measuring of actual releases might be disputed and have to be demonstrated through tests. Nevertheless, the possibility that surrogates exist with a command-and-control approach may be important if there are doubts

about the capabilities and accuracy of emission monitoring technologies now being developed.

It will probably be easier to reclaim enforcement costs from industry in the case of emission trading than with command-and-control. The savings in emission reduction costs to industry in having emission trading rather than command-and-control should outweigh any additional cost of enforcement and may be sufficient to justify the imposition of fees that would recover some or all of the government's enforcement costs.

Conclusions

[The following conclusions apply to command-and-control as well as to emission trading and thus do not address the relative merits of the two approaches. They are presented because they are important to the success of either strategy.]

- Penalties for infractions should be sufficient to provide an economic incentive for compliance. This means they should be made equal to the economic benefits derived from the infraction, plus a fine.
- Consideration should be given to allowing penalties to be assessed administratively rather than legally.
- An effective program depends on adequate resources for enforcement. Consideration should be given to the recovery of monitoring costs from all program participants and specific enforcement costs from offenders.

Between Jurisdictions: Enforcement And Equivalences

Issue

Can trades occur between jurisdictions? If atmospheric standards differ between the jurisdictions, what problems would arise?

Discussion

The difficulties to be addressed turn out to be the same whether there are two jurisdictions or more and whether they share a common airshed or have different airsheds.

If a trading region encompasses two or more jurisdictions the first question to arise concerns enforcement. If an emitter in jurisdiction A buys credits from an

emitter in jurisdiction B, enforcement will focus on ensuring that the reductions claimed in B are actually made. If there is a common airshed and if air quality standards and emission reduction goals are about the same in A and B, co-operative and equivalent enforcement will be likely. Both jurisdictions have a similar determination to secure emission reductions in the joint airshed.

However, if in B the air quality standards are more relaxed, or the pollution problem and thus the reduction goals are less severe, or there may be more concern about maintaining production and employment levels, than in A, the monitoring and enforcement effort may therefore be less than in A. Lax supervision might tempt an emitter in B to sell "surplus" allowances to emitters in A that are not really warranted by actual emission reductions made. This would lead to the false transfer of allowances, "paper trades", from B to A. Special interjurisdictional arrangements or agreements will thus be needed to ensure equivalent enforcement.

If goals and standards differ between the jurisdictions, trading equivalents will also have to be specified. For instance, if reduction of a particular contaminant is acknowledged to be more important to A than to B, this could be reflected in the trading rules, so that a reduction of 1 tonne in A is made equivalent to, say, a reduction of 2 tonnes in B. For another contaminant, A might have air quality minima whereas B does not. In that case, a trade from B to A (but not the other way) could be made conditional on showing that the results do not exceed the minimum air quality standards. This condition could also be pragmatically reflected in predefined trading ratios between locations or it could require (or allow the option of) demonstration with air dispersion modelling.

Conclusions

- Where environmental standards would not be compromised, trading between jurisdictions should be generally encouraged because of the benefits of broadening the universe of potential trades. When the jurisdictions are adjacent and share the same airshed, so that a single trading region makes geographic sense as well, the value of a joint program is enhanced.
- Management of interjurisdictional trades by a single air management authority would be ideal for consistency of enforcement. Where a management authority cannot be established, the jurisdictions involved must make agreements capable of ensuring that consistency. There will certainly be a need for monitoring and

reporting by each jurisdiction that is sufficient to enable the other jurisdiction(s) to verify the validity of purchased emission allowances.

Between Jurisdictions: Uniformity Of Practice

Issue

If a trading system is created across two or more jurisdictions, or if a jurisdiction is considering joining a trading system already in existence in another jurisdiction, what requirements are there for uniformity of practice? How far must participating jurisdictions go in harmonizing their procedures?

Discussion

Theoretical considerations and scattered evidence from American experience clearly favour as much uniformity as possible in administrative practices across all parts of the trading region. The harmful consequences to be feared from an unacceptable degree of administrative heterogeneity are essentially those mentioned earlier in relation to interjurisdictional and inter-regional trading: deficiencies of enforcement (Interjurisdictional Trades) and net shifts of emissions (Regional Imbalances).

The findings of Barakat & Chamberlin on U.S. emission trading experience give various indications of the importance of uniformity. Only the national programs studied have trading between jurisdictions. Of these, it is noteworthy that the proposed SO_2 program would use centrally issued standardized application forms "to ensure national consistency in informational requirements and to facilitate the market (in that utilities in different states will have the same administrative burden)" (p IV-4). The other two national programs examined, lead in gasoline and CFCs, appear to have a minimum of trading rules, and therefore a minimum of the administrative requirements that would raise uniformity issues. The case studies of local emission trading programs do not directly encounter and address the problem of varying administrative practices. But even here the analysis emphasizes the value of having a single administrative entity in charge of all aspects of the program.

From these considerations the following conclusions emerge about the admissible degree of administrative heterogeneity between trading jurisdictions:

- The issue is minimized by minimizing the trading rules and thus the administrative requirements and procedures involved.
- The more uniformity the better, but there is no threshold identifiable generically. Problems of heterogeneity would be reflected in such consequences as a diminution of trading activity, a long-term inter-regional net shift in emissions, or defects in enforcement.
- In any particular program, uniformity should be sought in the interjurisdictional discussions to establish the program, and the degree achieved will depend on circumstances.

Conclusion

- In a trading program in which trades are expected to cross jurisdictional boundaries, the administrative requirements and procedures imposed on participating firms should as far as possible be made uniform across trading regions.

New Administrative Requirements

Issue

What changes would an air management authority have to make to implement an emission trading program? Will there be a need for new skills and professional expertise, new monitoring, inventory, and recordkeeping systems?

Discussion

The administrative effort of an emission trading program will focus on the monitoring of emissions and the monitoring of allowance ownership. In emission trading the actual emissions of a source must be covered by the emission allowances held by that source. Allowances in excess of emissions are surplus; emissions in excess of allowances are illegal and subject to penalties.

The emission monitoring requirements are similar in principle to those required by command-and-control, though they may have to be more comprehensive and accurate because the installation of a specified technology cannot be used as a surrogate for actual measurement. However, the tracking of

allowance ownership is a new requirement imposed on government by emission trading.

The complexities of this "tracking" depend on the complexities of the trading rules, which in essence are the conditions of possession and transfer of allowances, and these will depend on the particular program. The following functions may be involved:

- At a minimum:
  - Registration of all participating sources and of the allowances in their possession.
  - Registration of all allowance transfers (trades).
  - Periodic reconciliation of allowances possessed with actual emissions monitored.
  - Reporting of all records, including initiation of penalizing procedures where indicated.
- Very likely:
  - Administration of banks for surplus allowances (deposits, withdrawals)
  - Administration of approval procedures for certain trades.
  - Trade-promotion services: publishing lists of surpluses, encouraging brokering.

The administrative load increases with the number of trading rules there are to administer and also with the amount of trading activity that occurs. However, the former and the latter tend to vary inversely.

An additional consideration is the need for regulators to become familiar with a new type of policy instrument. New knowledge, new skills, and new attitudes will develop along with the emission trading program itself. At the same time, the increasing intensity of command-and-control likely to be occurring during the development of emission trading will be stimulating similar changes. Emission trading will therefore contribute to new administrative requirements in air management but only as one of a number of new influences doing so.

Conclusions

- Emission trading will have specific administrative requirements, but they will not be additional to the new administrative resources that will be required in any case to meet emission control objectives.

- New skills, knowledge, and attitudes will be required for air management in a jurisdiction implementing an emission trading program.

Administrative Costs: Emission Trading Vs Command-And-Control

Issue

How do the administrative costs of an emission trading program compare to the administrative costs of a command-and-control program with an equivalent impact on emission control?

Discussion

The comparison of administrative costs must consider several factors. First is the relation of emission trading to command-and-control in a particular case. If the program implements emission trading instead of command-and-control, the question is simply which would cost more. However, if the program places emission trading on top of command-and-control (as do the local U.S. "emission reduction credit" programs studied by Barakat & Chamberlin), then the program's administrative cost is obviously higher than it would have been with command-and-control alone.

Second is the relative administrative costs of environmentally equivalent emission trading and command-and-control programs, considered as substitutes. On one hand, emission trading adds the cost of administering the trading rules, and it may well increase the costs of emission monitoring. On the other hand, emission trading relieves the government of the cost of evaluating best available control technology and applying it to every source. No systematic data are available from U.S. experience. However, from the information available the Working Group concludes that emission trading would not necessarily be more costly to administer and might cost less in the long term, and that the most appropriate assumption to make in an evaluation is that the two methods would cost roughly the same.

Third is the likelihood that it would be much easier for government to recapture its administrative costs from the sources with emission trading than with command-and-control. Since the allowances have both quantities and prices, there are many well-based options for assessing and imposing fees. Moreover, fees high enough to cover the administrative costs of emission trading can defended as

justifiable. Emission trading means savings for the private sector, and, unless very little trading occurs, these savings would be far higher than any incremental administrative cost to government.

Conclusions

- Though additional resources may be required to implement and administer an effective emission trading program (to achieve maximum cost savings to society), these resources will probably not be greater than those required to implement a truly effective command-and-control program.
- An air management authority considering the adoption of an emission trading program should:
  - seek to minimize administrative costs by allowing emission trading to act as far as possible as a substitute for rather than a supplement to command-and-control, and
  - evaluate types of transaction fees as a way to recapture administrative costs.

Taxation Of Emission Allowances

Issue

Emission allowances will be new private assets. What will their tax status be?

Discussion

When emission trading is introduced, governments will have to determine the tax rules which will apply to emission allowances. Potentially involved are three taxation systems: income, sales, and property. Since many jurisdictions are involved, this issue can only be flagged here.

Conclusion

- When an emission trading program is being designed, the various jurisdictions involved should be alerted to the need for new tax rules.

6. EMISSION TRADING IN THE LOWER FRASER VALLEY: PRELIMINARY ASSESSMENT

The Working Group was asked to examine the possibility that emission trading could be used as part of a program to control lower-level ozone pollution in the Vancouver area. To this end, the membership of the Working Group included representatives of the Greater Vancouver Regional District (GVRD), which administers air quality on behalf of BC Environment for most, though not all, of the Lower Fraser Valley.

The consultant reviewing the American experience with emission trading, Barakat & Chamberlin, was asked to apply its findings and conclusions from that review to the possibility of such a project for controlling ozone in the Lower Fraser Valley. The results of this supplementary assignment will now be outlined.

Scope

The study focuses in three ways:

- On the GVRD. The study suggests, but does not examine, the merits of extending emission trading beyond GVRD boundaries along further reaches of the Lower Fraser Valley in Canada and the United States.
- On emissions of NO_x and VOCs, as the precursors of lower-level ozone.
- On point sources. Excluded are mobile and area sources of NO_x and mobile, area, and gasoline marketing sources of VOCs. These exclusions represent types of emissions that are not easily quantified and monitored to the precision normally needed for emission trading. Nonetheless, some ways of including them in a trading program are mentioned.

Emission Quantities And Sources

According to GVRD data and forecasts, point source emissions represent only a small fraction of total emissions of both pollutants: 17% of NO_x and 9% of VOCs in 1985. These proportions are forecast to rise to 28% and 14% respectively by

2005. But the sources initially excluded continue to account for the large majority of total emissions.

Substantial uncertainty in inventories is indicated by a comparison with equivalent data cited in the CCME Management Plan for NO_x and VOCs. The CCME data and forecasts show much higher emissions of both kinds in the same region in 1985 and 2005 and declining NO_x emissions over the period rather than rising emissions as in the GVRD data.

The GVRD data for 1985 show for NO_x about 170 point sources (ie individual facilities, many of which have multiple stacks), with 63% of total emissions coming from six sources (two cement plants and four refineries).

For VOCs the same data show about 100 sources, with 70% of total emissions coming from the four refineries.

Ozone Episodes

In the Lower Fraser Valley, high ozone concentrations occur between March and September. A particular concern are ozone episodes, when certain weather conditions bring ozone concentrations higher than the federal government's one-hour objective. Most years have fewer than ten such episodes, which usually last one or two days.

Two possible goals are as follows:

- Never exceed the ambient standard.
- Exceed the ambient standard no more than three times in three years (U.S. Environmental Protection Act criterion).

Estimates indicate that the never-exceed goal could be achieved with reductions of 40% in NO_x and 73% in VOCs, while the three-in-three goal could be achieved with reductions of 40% in both NO_x and VOCs.

Program Options And Features

The assessment of options for the Lower Fraser Valley considers two types of trading programs (emission reduction credits and tradable allowances) and outlines a number of features desirable in any trading program.

Emission reduction credits vs tradable allowances

With an emission reduction credit program, a restricted form of emission trading, the emission reductions are achieved through command-and-control measures imposed on existing, modified, and new sources. Within-site trading ("netting") facilitates compliance by existing sources. Emission reduction credits are created when existing sources permanently reduce their emissions. The credits are purchased by new or expanding sources who must obtain authorization for their new or additional emissions.

With tradable allowances, a full-fledged emission trading program, command-and-control is not needed. An initial allocation of allowances to all emitters declines on an annual schedule towards the target reduction, and each source is required simply to provide the GVRD with allowances equal to its reported (monitored, audited) emissions. As their allowance allocation declines, the sources themselves decide whether (and when) to make actual emission reductions, creating surplus allowances for sale, or instead to purchase the allowances needed to authorize non-reduced emissions

Features

The preliminary assessment outlines a number of features to be considered in the design of an emission trading program in the Lower Fraser Valley. Some of these features are recommendations; others are issues to be addressed. The recommendations are as follows:

- If possible, try to include all sources.
- Create emission banks.
- Clearly specify monitoring, recordkeeping, and reporting requirements and responsibilities.
- Create a credible enforcement threat, so that detection of abuses is probable and penalties are high.
- Implement a fee structure adequate to finance the program.
- Ensure administrative efficiency, so that decisions are predictable, fast, and inexpensive.
- Seek participation of public and stakeholders in program development.

The issues to be addressed are as follows:

- Determine the base (historic) emission level for each source.

- Define participation thresholds if they are required.
- Establish offset ratios for trades if they are appropriate (eg 1 tonne saved allows 0.8 tonnes emitted).
- Establish geographic restrictions on trades.
- Consider interpollutant trading.

Seasonal And Episodic Considerations

Since ozone in the Lower Fraser Valley is a seasonal and episodic problem, some modifications to the potential program might be considered:

- "Winter" surplus allowances might be distinguished from "summer" surplus allowances, with the former usable only in winter. This would prevent winter savings being used to offset summer non-reductions.
- For each source the program could specify a maximum emission rate applicable during an ozone episode. This rate might be [target annual emissions/365].

The assessment suggests that these modifications, though practicable, may not be very useful. There may sometimes be little advantage to the seasonal operation of emission controls that is implied by seasonal allowances. Moreover, if the overall target reduction is achieved, the episodes may be prevented. Finally, the fact that the stationary sources participating in the program may initially represent 10 or 15% of total emissions means that their contribution to the episodes, particularly when they are already part of a reducing program, is very small.

Economic Benefits

The assessment identifies three kinds of economic benefits to be expected from an emission trading program in the Lower Fraser Valley:

- Avoiding overcontrol: Command-and-control would require all sources to install one of the proven control technologies. The resulting emission reduction would far exceed the target. Proven NO_x technologies can reduce emissions by 80% or more, and proven VOCs technologies can reduce emissions by as much as 99%. This degree of reduction would impose on the sources reached by command-and-control a share of the total reduction much higher than their share of total pollution. Emission trading would allow all sources to approximate the target reduction.

- Using a wider range of control options: Command-and-control typically focuses on control technologies of the kind just mentioned. But with emission trading any technique that reduced emissions can be used. For example, VOC emissions can be cut by switching to different solvents or coating formulations. With command-and-control, there is no incentive to implement measures other than those mandated.
- Overall cost savings: When all emission reduction measures for NO_x and VOCs are considered, their costs range from hundreds to tens of thousands of dollars per tonne. With such a wide range, there is a strong incentive for sources able to implement the cheapest solutions to do so and sell their surplus allowances to sources facing more expensive alternatives. It is precisely this situation in which emission trading is most economically advantageous.

These considerations support Barakat & Chamberlin's prediction that emission trading would produce economic benefits in the Lower Fraser Valley.

Market Competition

With six sources responsible for more than 60% of NO_x emissions and four of the same sources responsible for 70% of VOC emissions, the question arises whether, if a trading system is adopted, a few large firms will dominate the market.

The present assessment considers this degree of concentration in light of various technical criteria and concludes that "concern over possible noncompetitive behaviour is valid, but the concentration is not so high as to be alarming ... Small sources [will not be] captive buyers or sellers for the large sources." Mitigating mechanisms in the trading rules are discussed.

Conclusions And Recommendations

The preliminary assessment of the merits of a NO_x and VOCs emission trading program in the Lower Fraser Valley reaches the following conclusions:

- Either program (emission reduction credit or tradable allowance) appears feasible and economically advantageous.
- The goals should be clearly defined for fair evaluation.
- Emission inventories should be improved.
- Operating permits may require modifications to reporting and other requirements.

- Emission trading and air quality in the trading region should be the responsibility of a single authority.
- Support and participation of stakeholders and the public is vital.

RECOMMENDATIONS

- An emission trading program for the control of NO_x and VOCs in the Lower Fraser Valley is feasible. Specific issues of its potential application should be determined by stakeholder consultation on program design.
- BC Environment should propose explicit legislative authority to implement and fund an emission trading program in the Lower Fraser Valley.
- Environment Canada, BC Environment, GVRD, and other regional authorities should form a partnership to:
  - design,
  - implement, and
  - evaluate an emission trading program.

7. FUTURE CCME INVOLVEMENT

With this report, the Working Group concludes its assignment. Members of the Working Group considered possible additional future tasks which they might, as a group, undertake. Having fulfilled the need for an initial and generic assessment of emission trading, the question arose whether there was a next stage or step to which the Working Group could usefully contribute.

After some discussion it was concluded that for NO_x and VOCs, the appropriate next stage should be conducted regionally. A partnership of Environment Canada, BC Environment, the GVRD, and other local governments should proceed with assessment, consultation, and design in the Lower Fraser Valley. Using the findings and conclusions of the present report, parallel regional groups should be established for similar action in the Windsor/Quebec Corridor and the St John, New Brunswick, area.

The SO_2 Working Group, which merged with the Emission Trading Working Group for the present study, should reassemble and, with the results of the present study in hand, determine its future direction.

The question remained whether CCME should consider any further role in the emission trading area. The Working Group concluded that further action by CCME would be desirable. In particular, CCME could play a supportive and sponsoring role for the regional groups, who may find their own task easier if national support for and interest in emission trading initiatives were evident.

These views have led to the following recommendations. With these being presented, the Working Group concludes its task.

RECOMMENDATIONS

- CCME should encourage and support the formation of provincially led regional groups (ie in the Windsor/Quebec Corridor and in the St John, New Brunswick, area) to evaluate the potential for emission trading to address NO_x and VOCs control in their areas.

- The CCME task force studying the use of emission trading for SO_2 should review the findings of U.S. experience and the policy implications in assessing the benefit of an SO_2 trading program in Canada.
- CCME should sponsor early information sessions on emission trading intended to increase understanding among the public and stakeholders and promote the development of regional emission trading initiatives.
- CCME should monitor and assess regional emission trading programs and should also evaluate the feasibility of emission trading programs for other atmospheric contaminants and other geographic areas.

8. LIST OF RECOMMENDATIONS AND CONCLUSIONS

Recommendations

- CCME should endorse the concept of emission trading as a potentially valuable instrument of public policy for air management. (p 25)
- An emission trading program for the control of NO_x and VOCs in the Lower Fraser Valley is feasible. Specific issues of its potential application should be determined by stakeholder consultation on program design. (p 63)
- BC Environment should propose explicit legislative authority to implement and fund an emission trading program in the Lower Fraser Valley. (p 63)
- Environment Canada, BC Environment, GVRD, and other regional authorities should form a partnership to:
  - design,
  - implement, and
  - evaluate an emission trading program. (p 63)
- CCME should encourage and support the formation of provincially led regional groups (ie in the Windsor/Quebec Corridor and in the St John, New Brunswick, area) to evaluate the potential for emission trading to address NO_x and VOCs control in their areas. (p 64)
- The CCME task force studying the use of emission trading for SO_2 should review the findings of U.S. experience and the policy implications in assessing the benefit of an SO_2 trading program in Canada. (p 65)
- CCME should sponsor early information sessions on emission trading intended to increase understanding among the public and stakeholders and promote the development of regional emission trading initiatives. (p 65)
- CCME should monitor and assess regional emission trading programs and should also evaluate the feasibility of emission trading programs for other atmospheric contaminants and other geographic areas. (p 65)

Conclusions

Policy and design issues

Program design: program goals and pollutant characteristics

- The trading rules developed in an emission trading program must be tailored to the specific air management goal(s) of the program and must reflect the characteristics of the pollutants covered by the program. (p 27)
- Emission allowances granted by an emission trading program must be made clearly conditional or time-bounded to ensure that the program does not conflict with future air management requirements. (p 27)

Scope of market: sources

- An emission trading program should include all sources in the trading area (point, non-point, and mobile) which are able to show that the creation or use of a surplus emission allowance:
  - can be adequately quantified, monitored, and enforced
  - would not violate any other environmental standard or regulation. (p 30)

Scope of market: pollutants

- Interpollutant trading rules should be incorporated to include within a program as many pollutants as can be assigned environmental equivalences. (p 31)
- All air pollutants should be considered potentially eligible for inclusion in emission trading programs except those classed as having unacceptable local impacts (eg toxic, reactive, explosive). (p 31)

Scope of market: levels of trading

- Emission trading limited within a site or between sites within a firm has important independent value and should be considered in many situations where full, between-firm emission trading may not be appropriate. (p 33)

Initial allocation of emission allowances

- The initial allocation of allowances should recognize existing emission sources and not be carried out by auction. (p 35)

Structuring the initial allocation

- The initial allocation could be based on a historical averaging of actual emissions over a selected period, and a transition period could be used to bring existing sources to a common emission standard by accelerated reduction in their emission allowances. (p 39)
- New sources should be required to purchase the emission allowances they need. (p 39)
- Within social and legal constraints, the maximum economic benefits will be achieved where new sources are not required to meet pre-set technological standards before trades are allowed. (p 39)

Fairness between sources inside the program and sources outside

- Complementary control programs should be implemented for sources not included in the trading program. (p 40)
- The trading program must have the flexibility to accept additional types of sources as it becomes possible to quantify, monitor, and enforce their emissions. (p 40)

Regional imbalances

- Program designers should consider the potential for desired and undesired net shifts of emissions between areas or regions and incorporate mechanisms to encourage or prevent them as necessary. (p 41)

Banking of surplus emission allowances

- Emission trading programs should establish banking systems and rules for surplus allowances. The rules involved (eg quantity or rate banking) should be designed to reflect program goals and pollutant characteristics. (p 44)
- The banking rules and system will be most effective if they express a commitment that surpluses deposited will be held safely and not singled out for confiscation, discounting, or time-limitation. (p 44)

Maintaining a competitive market

- To maintain a competitive market in emission allowances, trading rules should establish measures to help bring buyers and sellers together, minimize transaction costs while maintaining environmental standards, and prevent hoarding of surplus allowances. (p 46)

Shutdown credits

- Constraints on shutdown credits should be developed to prevent windfall profits and abuse (p 47)

ADMINISTRATIVE ISSUES

Legislative authority

- Environmental management plans and regulatory proposals should not exclude emission trading as an option. (p 49)
- Unless there are strong reasons not to do so, explicit legislative authorization for emission trading should be sought where it does not exist, even when there appear to be no current legislative obstacles standing in the way. (p 49)

Monitoring and Enforcement

[The following conclusions apply to command-and-control as well as to emission trading and thus do not address the relative merits of the two approaches. They are presented because they are important to the success of either strategy.]

- Penalties for infractions should be sufficient to provide an economic incentive for compliance. This means they should be made equal to the economic benefits derived from the infraction, plus a fine. (p 51)
- Consideration should be given to allowing penalties to be assessed administratively rather than legally. (p 51)
- An effective program depends on adequate resources for enforcement. Consideration should be given to the recovery of monitoring costs from all program participants and specific enforcement costs from offenders. (p 51)

Between jurisdictions: enforcement and equivalences

- Where environmental standards would not be compromised, trading between jurisdictions should be generally encouraged because of the benefits of broadening the universe of potential trades. When the jurisdictions are adjacent and share the same airshed, so that a single trading region makes geographic sense as well, the value of a joint program is enhanced. (p 52)
- Management of interjurisdictional trades by a single air management authority would be ideal for consistency of administration and enforcement. Where a management authority cannot be established, the jurisdictions involved must make agreements capable of ensuring that consistency. There will certainly be a need for monitoring and reporting by each jurisdiction that is sufficient to enable the other jurisdiction(s) to verify the validity of purchased emission allowances. (p 52)

Between jurisdictions: uniformity of practice

- In a trading program in which trades are expected to cross jurisdictional boundaries, the administrative requirements and procedures imposed on participating firms should as far as possible be made uniform across trading regions. (p 54)

New administrative requirements

- Emission trading will have specific administrative requirements, but they will not be additional to the new administrative resources that will be required in any case to meet emission control objectives. (p 55)
- New skills, knowledge, and attitudes will be required for air management in a jurisdiction implementing an emission trading program. (p 56)

Administrative costs: emission trading vs command-and-control

- Though additional resources may be required to implement and administer an effective emission trading program (to achieve maximum cost savings to society), these resources will probably not be greater than those required to implement a truly effective command-and-control program. (p 57)
- An air management authority considering the adoption of an emission trading program should:

- seek to minimize administrative costs by allowing emission trading to act as far as possible as a substitute for rather than a supplement to command-and-control, and
- evaluate types of transaction fees as a way to recapture administrative costs. (p 57)

Taxation of emission allowances

- When an emission trading program is being designed, the various jurisdictions involved should be alerted to the need for new tax rules. (p 57)